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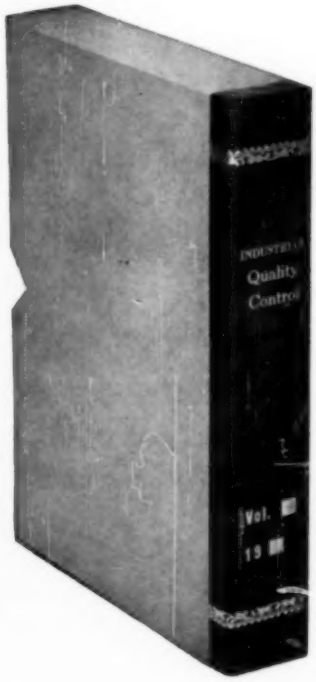

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From the President's Desk

ON STANDARDIZATION

"Standards are at the base of all mass production. . . . They have cheapened the cost of production in millions of directions. They have enabled thousands of different articles to be placed within the reach of everybody." So said Herbert Hoover at an Annual Meeting of the American Standards Association a few years ago.

The idea of standardizing is however by no means new. Let's look back for a moment into days gone by. Here's an abstract from an ordinance of Charles I of England, dated 1631, standardizing armor, pikes and bandoliers (*Standardization*, May 1950, p. 108):

> "And because we are credibly given to understand that the often and continual altering and changing of the fashion of armes and armours, some countrys and parts of the Kingdome having armours of one fashion, and some of another, do put many of our subjects to a great and unnecessary charge, and more than need requireth for the avoiding whereof, our will and pleasure is, and we do hereby appoint and command, that hereafter there shall be but one uniform fashion of armours of the same common and trayned bands throughout our said Kingdome of England and domynion of Wales, when as any of the said armours shall be supplied and made, and that form and fashion of armour shall be to the last and modern fashion lately set down and appoynted to be used by the lords and others of our Council of Warre (the patterns, whereof are now and shall remain in the office of our ordinance from tyme to tyme, which is our pleasure likewise concerning gunnes, pikes, and bandaliers whereof patterns are and shall remayn from tyme to tyme in our said office)."

In the 1800's, "Like the one I got from you last time" was a common basic standard used in buying articles produced in small quantities by skilled craftsmen. Here, too, was invoked the concept of *exact* science, in which attempts are made to produce parts to exact dimensions—"the same as" a particular model or pattern. "Like" and "the same as" meant one thing then but something quite different to-day as we visualize process variabilities and frequency distributions and place suitable targets and tolerances in our standards.

We are guided by standards in nearly everything we do. Many of our accepted standards, such as, red traffic signals to mean "Stop", the height of the kitchen sink, and the 6½ size of my lady's gloves, are the result of what has been found most convenient or expedient as a matter of custom. This appears to be so whether the standard under consideration is a way of *doing* things, a way of *making* things, or a way of *saying* things. But in these days of mass production there has developed a more or less scientific approach to the problem of standardization, particularly among the various technical societies, trade associations, and Government bureaus, often working at a national level through the American Standards Association.

The first two standards adopted by our relatively young Society deal with standard definitions and symbols in two general areas of activity—control charting and acceptance sampling. This was a natural first move since the field of quality control makes extensive use of certain unique concepts and terms, such as "assignable causes", "rational subgroups", "3-sigma limits", "acceptance number", and "AOQL", that constitute rather a special language—jargon, perhaps, to others, if we do not make clear just what we mean.

As a result of industry-government cooperation in standards work in recent years, the Government is increasingly following the practice of using industry standards as a base in procurement. As the A. S. A. points out: "This new policy will increase Federal efficiency, conserve materials and man-power, and save untold millions in production and procurement." The preparation of standards—good standards—requires much hard work and many long hours in Committee meetings by those who are expert in the field. We, as quality control workers, should contribute in our individual spheres of activity.

Sincerely,

Leon Bass

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quality control of Inventory Turnover*

LOUIS B. KAHN†

Introduction

THE CONTROL OF INVENTORY is a common responsibility of every functional department of business. A look at the organization chart of the company should convince even the most skeptical: the treasurer is interested in having sufficient working capital, and one of the best ways to increase liquid assets is to reduce the investment in inventory; the controller desires to improve budget policies and procedures, and this requires that forecasts of sales be accurate and inventory accumulations be kept to a minimum; the production manager has to dispose of obsolete and slow-moving raw materials and finished goods for they add to his costs without resulting in increased revenues; the sales manager wants to give good service to customers by providing them with the desired products within a short delivery period, but at the same time, he wants to avoid leaving the company with out-of-date inventories at the end of the production season.

Thus, no matter what functional area of business one turns to, there is a desire to increase inventory turnover and to reduce inventory investment. At the same time, it has been recognized that many of the currently employed techniques for measuring inventory turnover are rather crude and cumbersome. In previous articles by the author[1,2] it was demonstrated that the commonly used method of sales-inventory ratios provide poor indicators of inventory turnover, since they are based on the assumption that inventories are homogeneous, although everyone is aware that different items of inventory do in fact have rates of turnover that vary from the "very fast" to the "dead." Instead of the sales-inventory ratios, it was suggested that an "Index of Activity" be used to characterize the turnover of each stock item comprising the total inventory. In this way, the turnover of different stock items is measured by specific indexes of activity, which may vary from "fast" to "dead."

The purpose of this article is to take the concepts and formulas developed in these earlier papers and to show how they can be applied in the general framework of a control procedure.‡ Tagged with an index of activity, the turnover of each item comprising the inventory can be carefully watched and evaluated by the use of generally accepted control procedures. In this way, stock items can be compared with each other as to their relative activity; or the activities of a specific item for different periods can be compared.

The Activity Index Formula

The rate of turnover for each stock item of the total inventory, for a given period, is derived by the following simple formula:

$$I_p = \frac{V_p\, T_p}{p^2\, B_c}$$

where p equals the period studied in months; V_p equals the total quantity of the item sold during the period; T_p equals the total number of transactions covering sales during the period; and B_c equals the current "on-hand balance" or inventory at the end of the period studied (including any material due in or on order). The perpetual inventory cards maintained by the company provide the source for obtaining the necessary data required to compute the indexes of activity. Thus, the formula relates a weighted demand with a weighted inventory level. The demand V_p is weighted by the number of transactions T_p, which acts as a velocity factor, and the inventory level is weighted by a time factor.

Stock items with a high index are important items, from an inventory turnover point of view, and should be examined carefully as to their stock status. This does not mean that their inventories should necessarily be increased. But procurement policies may need to be reviewed. Stock items with a low index are also important, because they point to situations where there may be a large inventory build-up and a low weighted demand.

There are stock items with levels of activity between these extreme points which can be characterized as items with "normal" inventory turnover. The general characteristics and behavior of the formula are described in the papers referred to in the References section.

Control Chart for Multi-Stock Inventory

Figure 1 illustrates the use of a control chart for evaluating stock turnover of a multi-stock inventory. The ordinate designates the indexes of activity covering the average stock turnover per period. Although quarterly periods are given on the time scale, indexes can be plotted for any arbitrary period such as monthly or semi-annually. If an electronic computer is available

*Presented at the September 10, 1957 meeting of the Western Quality Control Conference of ASQC, San Francisco, California.

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‡There is no attempt at present to relate this procedure with techniques for determining reorder points generally proposed in the operations research field, which balance the risk and cost of being out of stock with the risk and cost of maintaining excessive stock. The author hopes to show a relationship between these costs and the indexes of activity in a later paper to be published under the auspices of the Logistics Research Project, George Washington University.

for quick calculations covering the turnover of a multi-stock inventory, the graph can be used with a shorter time scale—even daily, if necessary.

The lower portion of the chart shows the relative sigma levels which have been used in designating the different gradations of stock activity. In this illustration, the "flagged" region lies between the three and four sigma levels, indicating "fast" and "inactive" stock turnover, in the upper and lower bands, respectively. As stated, these are regions where an evaluation of stock status relative to demand should be made. The "skull and crossbones" region lies between the four and five sigma levels, indicating "super-fast" and "dead" stock turnover, in the upper and lower bands, respectively. As stated in the chart, these are "trouble" regions where management should take immediate action, for the inventory is running out relative to demand in the first case; and excessive backlog of stock with little or no demand has occurred in the second case.

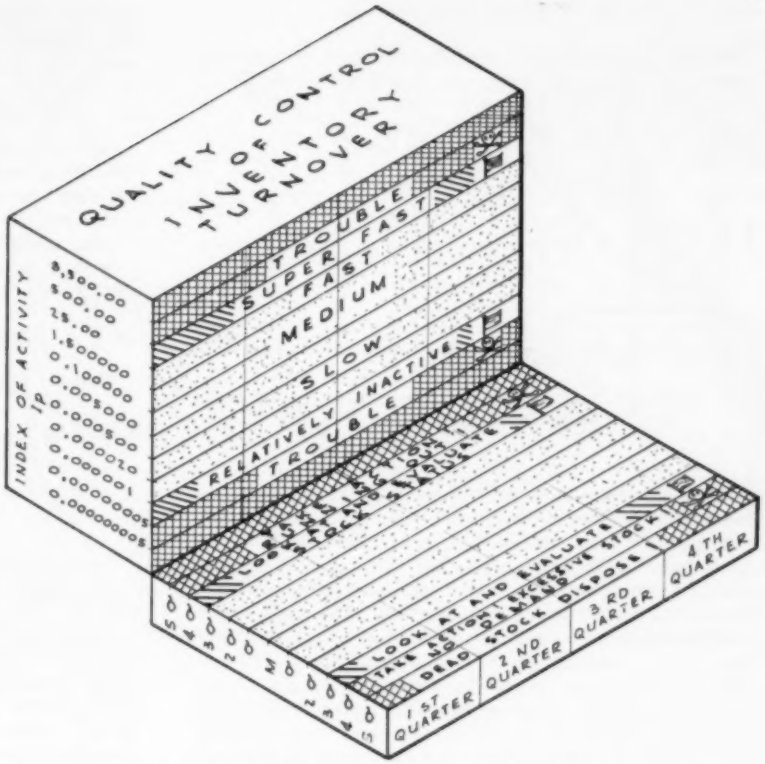

Figure 1—Control Chart for a Multi-Stock Inventory

Although the control areas shown on the chart have been derived by taking the sigma levels as equally spaced from the mean log index, there is nothing to prevent the Inventory Manager from taking any multiple standard deviation of the log index in order to determine his evaluation and action areas.* As in any control program, the portion of items, or of activity indexes of a given item, that he wishes to bring to his attention for evaluation for action—because they are out of control—is a function of the risk level that he is willing to assume.

The control limits—or stock turnover tolerances—are readily determined by an evaluation of past stock turnover, where the average turnover for the period, and variance of such stock turnover, is ascertained. Figure 2 shows the result of one such study, covering a period of twelve months. It is quite evident that the indexes of activity are logarithmico-normally distributed. Using this fact, we can readily select the risk levels for controlling the stock turnover by referring to the tables of the Standardized Normal Distribution with

$$t_{1-\alpha} = \frac{\log I_p - M\{\log I_p\}}{\sigma\{\log I_p\}}$$

where α denotes the risk associated with any specified activity level, and $M\{\log I_p\}$ and $\sigma\{\log I_p\}$ denote the mean of the log index and standard deviation of the log index, respectively. Thus, to set a risk level of one percent to denote the "action area" and a risk of five percent to denote the "evaluation area," the control limits are designated by

(1) Action: $\log I_p^{99} = M\{\log I_p\} \pm t_{99}\,\sigma\{\log I_p\}$

(2) Evaluation: $\log I_p^{95} = M\{\log I_p\} \pm t_{95}\,\sigma\{\log I_p\}$

Thus, for a multi-stock inventory comprised of 500 items with an average turnover rate of $\log I_p = -1.1412639$ and a standard deviation of $\log I_p = 1.1381608$, the control limits are set as follows:

(1) Action: $\log I_p^{99} = -1.1412639 \pm 2.54\ (1.138^+)$

(2) Evaluation: $\log I_p^{95} = -1.1412639 \pm 1.96\ (1.138^+)$

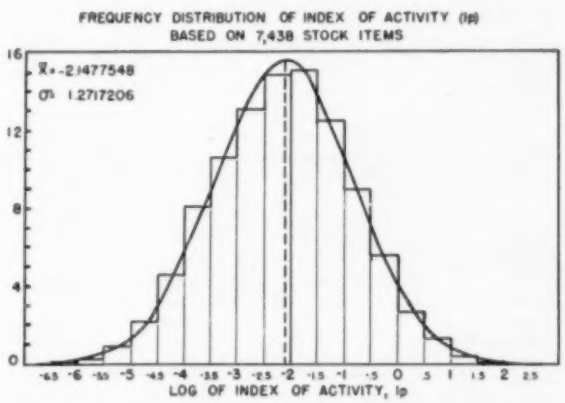
FREQUENCY DISTRIBUTION OF INDEX OF ACTIVITY (Ip)
BASED ON 7,438 STOCK ITEMS
X̄= -2.1477548
σ= 1.2717206
16
12
8
4
0
-6.5 -6 -5.5 -5 -4.5 -4 -3.5 -3 -2.5 -2 -1.5 -1 -.5 0 .5 1 1.5 2 2.5
LOG OF INDEX OF ACTIVITY, Ip

Figure 2—Frequency Distribution of a Multi-Stock Inventory Showing Logarithmico-Normality of the Indexes of Activity, I_p

*It will be noted that the standard deviation of the log index is calculated by the root-mean-square method. In analyzing time series, including inventory data from period to period, some quality control people generally prefer to use differences between adjacent terms in the series to compute the standard deviation, and to regard the cyclical changes and trends, usually present in such data, as assignable causes of variation. In typical cases, the standard deviation computed from first differences is smaller than when computed from the root-mean-square. This will thereby result in a closer control of inventory turnover.

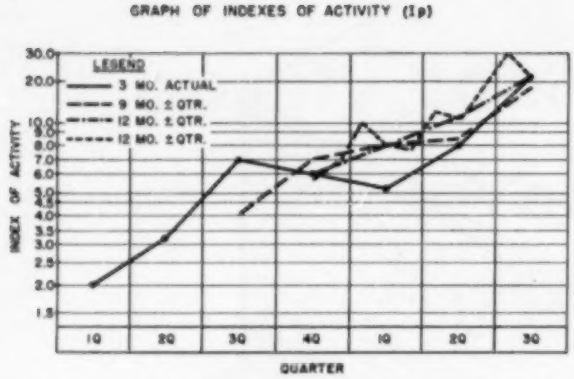

Figure 3—Control Chart for a Selected Stock Item Showing Stock Turnover on a Quarterly Basis

Although the historical average is being used as the center line for the control chart, there is a danger that this average may not be the most desirable level of operations. It is conceivable that the use of a control chart in some instances might tend to result in a loss because of a poor choice of center line. The danger just mentioned might largely be avoided if some good formula were used for reordering during the period for which the average was computed. The control chart, using the activity index as an indicator of stock turnover only serves as an adjunct to some such formula by revealing instances where the formula was not consistently employed or where new developments indicate a revision of the formula might be desirable.

Since the activity formula is comprised of such factors as transactions and quantity, these two factors can be related so as to determine the average quantity per transaction per period. This information can then be used in predicting inventory levels for the coming period by use of the Negative Binomial Distribution.* Other formulas can be developed which will aid in determining reorder points; however it is not the purpose of this article to delve further into this area but only to point out that the use of an activity index aids in evaluating the extent and even "efficiency" of inventory turnover, currently characterized by the sales-inventory ratio, also an indicator of such turnover.

Other similar studies covering various multi-stock inventory situations have been made. The calculated parameters required for control purposes are given in Table I. Reference to this table shows that the average turnover between multi-stock inventories have a considerable range in activity, but the variation remains fairly constant, with the exception of optical equipment, in this case.

*The use of this technique is described by the author with Harry M. Hughes, "Another Look at the Inventory Problem," *Logistic Papers*, George Washington University Logistics Research Project (ONR), 1956.

TABLE I—Summary of Average Stock Turnover for Selected Multi-Stock Inventories, According to the Index of Activity (Log I_p)

Type of Material	Period of Study p-months	Average Activity M {log I_p}	Standard Deviation σ {log I_p}
Brooms, Brushes	12	—0.700000	1.103362
Caskets	24	—2.271062	1.3403362
Clothing	12	—1.814267	1.223482
Drugs	24	—1.760645	1.410910
Electrical Wire	6	—2.137931	1.067250
Hand Tools	12	—1.797306	1.110432
Lamps	12	—2.057779	1.149856
Nuts and Bolts	12	—2.147755	1.350809
Optical Equipment	21	—2.180662	0.840564
Stationery	12	—1.422330	1.165384

Control Chart for a Selected Stock Item

Figure 3 illustrates the use of a control chart for evaluating stock turnover for a selected stock item. In this case, no control limits have been placed on the chart, but if we are to follow the guide-lines used on the multi-stock control chart, we can derive the necessary control limits by using the fact that the average stock turnover for this type of material is log $I_p = -1.3691589$ with a standard deviation, log $I_p = 1.3157975$.

Control Limits of I_p	Activity	Action
9.98×10^{-5} — 18.30	Normal	None
18.30—378.6	Fast-Moving	Evaluation
> 378.6	Super-Fast	Look at Stock Status

Obviously, these control limits can easily be denoted on log paper, making it unnecessary to translate the original data into logarithmic activity indexes. The logarithmico-normal characteristics of the underlying probability distribution points to the desirability of using logarithmic-probability paper, in determining the sigma values for any designated risk level. Thus, the control limits can easily be determined by the use of graphical methods.

It will be noted that the control limits really are concerned with the upper bands of the multi-stock inventory covering this particular type of material since the stock item being controlled in this case is a relatively highly active item. Evidently, some further adjustment of the control limits can be made, if the Inventory Manager feels that the region marked by the "Fast-Moving" band (18.30 to 378.6) should call for action rather than evaluation of stock status. In looking at the chart, we find a consistently rising index of activity, and note that the index covering the last quarter has moved into a decision-making area, which probably will call for some stock status-and-demand review.

When dealing with the development of a control chart for specific stock items in a multi-stock inventory, a great amount of flexibility is permitted in determining the control limits for decision-making. In this particular case, the average activity for the total inventory was used in deriving the control limits for a specific stock item. However, the average activity for the item itself could have been used just as well. This would allow for a specific control on a single item, whose activity is evaluated independently of the activity of other stock items of the same type in the total inventory. It becomes quite evident that the control, in this instance, will be much more rigid, and may call for action somewhat earlier than shown in the illustration above.

Summary

This article has served to introduce the concept of controlling the turnover of a multi-stock inventory, using an Index of Activity as a measure of inventory turnover for each of the stock items comprising the total inventory. The control limits are readily calculated using specific risk levels which designate "evaluation" and "action" areas for the Inventory Manager,

which means that only a certain number of stock items contained in the multi-stock inventory will be brought to his attention for review and necessary action, depending on the conditions that may arise. The use of a simple formula for determining indexes of activity makes possible a ready and immediate knowledge of the turnover of large multi-stock inventories through the use of an electronic computer.

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(1) Kahn, Louis B. and Suojanen, Waino W., "Useful Activity Indexes by Inventory Fractionation," *N.A.C.A. Bulletin*, Vol. 36, January 1955, 672-681

(2) Kahn, Louis B., *A Study of the Operational Fractionation of Inventory at NSC, Oakland* (Naval Supply Center, Oakland, Calif., May 1954)

Tables for One-Sided Statistical Tolerance Limits*

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Introduction

The quality of manufactured product is often specified by setting a range, the bounds of which are called tolerance limits. These limits have the property that a certain percentage, $100(1-\alpha)$ percent, of the product may be expected to fall within these limits. If the quality of the items is normally distributed with *known* mean, $\bar{X}'$, and *known* standard deviation, σ', two-sided tolerance limits are formed by adding to and subtracting from $\bar{X}'$ the quantity $K_{\alpha/2}\,\sigma'$, where $K_{\alpha/2}$ is the normal deviate corresponding to $\alpha/2$. An upper one-sided tolerance limit is given by $\bar{X}' + K_\alpha\sigma'$ and a lower one-sided tolerance limit is given by $\bar{X}' - K_\alpha\sigma'$. Unfortunately, in practice, the values $\bar{X}'$ and σ' are rarely known and estimates of these values, $\bar{X}$ and s, respectively, are used. As a result of the use of these estimates, a probability statement, such as, 95 percent of a manufactured product will lie below $\bar{X} + 1.645s$ is not correct, whereas a similar statement involving $\bar{X}' + 1.645\sigma'$ is proper. The quantities $\bar{X}$ and s are random variables, and hence the limit depends upon the particular outcome of the sample. Different samples will lead to different limits. How close these limits are to $\bar{X}' + 1.645\,\sigma'$ depends upon how good the estimates are.

It is evident then that the fraction of the items included between

a. $[\bar{X} - K_{\alpha/2}s,\ \bar{X} + K_{\alpha/2}s]$ for two-sided tolerance limits,

b. $[-\infty,\ \bar{X} + K_\alpha s]$ for an upper one-sided tolerance limit, and

c. $[\bar{X} - K_\alpha s, \infty]$ for a lower one-sided tolerance limit

will not always contain a specified proportion $1-\alpha$ of the manufactured items. However, it is possible to determine constants K such that in a large series of samples from a normal distribution, a fixed proportion γ of the intervals

a. $[\bar{X} - Ks,\ \bar{X} + Ks]$ for two-sided tolerance limits,

b. $[-\infty,\ \bar{X} + Ks]$ for an upper one-sided tolerance limit, and

c. $[\bar{X} - Ks, \infty]$ for a lower one-sided tolerance limit

will include $100(1-\alpha)$ percent or more of the distribution. The finite limits of these intervals are known as statistical tolerance limits. Thus, an upper one-sided statistical tolerance limit is given by $\bar{X} + Ks$ and has the property that the probability is equal to a preassigned value γ that the interval $[-\infty,\ \bar{X} + Ks]$ includes at least a specified proportion $1-\alpha$ of the distribution. Note that in most practical situations γ is usually close to one.

Statistical tolerance intervals should not be confused with confidence intervals for a parameter of the distribution. Confidence limits for the mean of a normal distribution are such that in a given fraction, say 0.95, of the samples from which they are computed, the interval bounded by the limits will include the true mean of the distribution. For confidence interval estimation, 0.95 is also called the confidence coefficient.

Many extensive tables of factors K for *two-sided* tolerance limits have been computed. A. H. Bowker presented such a table [1] and very recently A. Lieberman issued a set of tables[2] which are an extension of Bowker's tables in that they can be used when s is computed from sample sizes other than n. Resnikoff[3] and Mitra[4] computed values of K when σ' is estimated by the average range of subgroups. Tables of factors K for one-sided tolerance limits have never been computed and it is the purpose of this article to present such tables.

Tables of One-Sided Tolerance Limits

Factors K, such that $\bar{X} + Ks$ and $\bar{X} - Ks$ are an upper one-sided tolerance limit and a lower one-sided toler-

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TABLE I—Tolerance Factors for Normal Distributions

Factors K such that the probability is γ that at least a proportion $1-\alpha$ of the distribution will be less than $\bar{X} + Ks$ (or greater than $\bar{X} - Ks$), where $\bar{X}$ and s are estimates of the mean and the standard deviation computed from a sample of size n.

	$\gamma = 0.75$					$\gamma = 0.90$					$\gamma = 0.95$					$\gamma = 0.99$				
n \ α	0.25	0.10	0.05	0.01	0.001	0.25	0.10	0.05	0.01	0.001	0.25	0.10	0.05	0.01	0.001	0.25	0.10	0.05	0.01	0.001
3	1.464	2.501	3.152	4.396	5.805	2.602	4.258	5.310	7.340	9.651	3.804	6.158	7.655	10.552	13.857					
4	1.256	2.134	2.680	3.726	4.910	1.972	3.187	3.957	5.437	7.128	2.619	4.163	5.145	7.042	9.215					
5	1.152	1.961	2.463	3.421	4.507	1.698	2.742	3.400	4.666	6.112	2.149	3.407	4.202	5.741	7.501					
6	1.087	1.860	2.336	3.243	4.273	1.540	2.494	3.091	4.242	5.556	1.895	3.006	3.707	5.062	6.612	2.849	4.408	5.409	7.334	9.540
7	1.043	1.791	2.250	3.126	4.118	1.435	2.333	2.894	3.972	5.201	1.732	2.755	3.399	4.641	6.061	2.490	3.856	4.730	6.411	8.348
8	1.010	1.740	2.190	3.042	4.008	1.360	2.219	2.755	3.783	4.955	1.617	2.582	3.188	4.353	5.686	2.252	3.496	4.287	5.811	7.566
9	0.984	1.702	2.141	2.977	3.924	1.302	2.133	2.649	3.641	4.772	1.532	2.454	3.031	4.143	5.414	2.085	3.242	3.971	5.389	7.014
10	0.964	1.671	2.103	2.927	3.858	1.257	2.065	2.568	3.532	4.629	1.465	2.355	2.911	3.981	5.203	1.954	3.048	3.739	5.075	6.603
11	0.947	1.646	2.073	2.885	3.804	1.219	2.012	2.503	3.444	4.515	1.411	2.275	2.815	3.852	5.036	1.854	2.897	3.557	4.828	6.284
12	0.933	1.624	2.048	2.851	3.760	1.188	1.966	2.448	3.371	4.420	1.366	2.210	2.736	3.747	4.900	1.771	2.773	3.410	4.633	6.032
13	0.919	1.606	2.026	2.822	3.722	1.162	1.928	2.403	3.310	4.341	1.329	2.155	2.670	3.659	4.787	1.702	2.677	3.290	4.472	5.826
14	0.909	1.591	2.007	2.796	3.690	1.139	1.895	2.363	3.257	4.274	1.296	2.108	2.614	3.585	4.690	1.645	2.592	3.189	4.336	5.651
15	0.899	1.577	1.991	2.776	3.661	1.119	1.866	2.329	3.212	4.215	1.268	2.068	2.566	3.520	4.607	1.596	2.521	3.102	4.224	5.507
16	0.891	1.566	1.977	2.756	3.637	1.101	1.842	2.299	3.172	4.164	1.242	2.032	2.523	3.463	4.534	1.553	2.458	3.028	4.124	5.374
17	0.883	1.554	1.964	2.739	3.615	1.085	1.820	2.272	3.136	4.118	1.220	2.001	2.486	3.415	4.471	1.514	2.405	2.962	4.038	5.268
18	0.876	1.544	1.951	2.723	3.595	1.071	1.800	2.249	3.106	4.078	1.200	1.974	2.453	3.370	4.415	1.481	2.357	2.906	3.961	5.167
19	0.870	1.536	1.942	2.710	3.577	1.058	1.781	2.228	3.078	4.041	1.183	1.949	2.423	3.331	4.364	1.450	2.315	2.855	3.893	5.078
20	0.865	1.528	1.933	2.697	3.561	1.046	1.765	2.208	3.052	4.009	1.167	1.926	2.396	3.295	4.319	1.424	2.275	2.807	3.832	5.003
21	0.859	1.520	1.923	2.686	3.545	1.035	1.750	2.190	3.028	3.979	1.152	1.905	2.371	3.262	4.276	1.397	2.241	2.768	3.776	4.932
22	0.854	1.514	1.916	2.675	3.532	1.025	1.736	2.174	3.007	3.952	1.138	1.887	2.350	3.233	4.238	1.376	2.208	2.729	3.727	4.866
23	0.849	1.508	1.907	2.665	3.520	1.016	1.724	2.159	2.987	3.927	1.126	1.869	2.329	3.206	4.204	1.355	2.179	2.693	3.680	4.806
24	0.845	1.502	1.901	2.656	3.509	1.007	1.712	2.145	2.969	3.904	1.114	1.853	2.309	3.181	4.171	1.336	2.154	2.663	3.638	4.755
25	0.842	1.496	1.895	2.647	3.497	0.999	1.702	2.132	2.952	3.882	1.103	1.838	2.292	3.158	4.143	1.319	2.129	2.632	3.601	4.706
30	0.825	1.475	1.869	2.613	3.454	0.966	1.657	2.080	2.884	3.794	1.059	1.778	2.220	3.064	4.022	1.249	2.029	2.516	3.446	4.508
35	0.812	1.458	1.849	2.588	3.421	0.942	1.623	2.041	2.833	3.730	1.025	1.732	2.166	2.994	3.934	1.195	1.957	2.431	3.334	4.364
40	0.803	1.445	1.834	2.568	3.395	0.923	1.598	2.010	2.793	3.679	0.999	1.697	2.126	2.941	3.866	1.154	1.902	2.365	3.250	4.255
45	0.795	1.435	1.821	2.552	3.375	0.908	1.577	1.986	2.762	3.638	0.978	1.669	2.092	2.897	3.811	1.122	1.857	2.313	3.181	4.168
50	0.788	1.426	1.811	2.538	3.358	0.894	1.560	1.965	2.735	3.604	0.961	1.646	2.065	2.863	3.766	1.096	1.821	2.296	3.124	4.096

ance limit, respectively, for a normal universe, are given in Table I for n = 3,4,...,25,30,35,40,45,50; for $\gamma = 0.75$, 0.90, 0.95, 0.99; and for $\alpha = 0.25$, 0.10,0.05,0.01,0.001. $\bar{X}$ is the sample mean, $\bar{X} = (X_1 + X_2 + \ldots + X_n)/n$, and s is the sample standard deviation

$$s = \sqrt{\frac{(X_1 - \bar{X})^2 + (X_2 - \bar{X})^2 + \ldots + (X_n - \bar{X})^2}{(n-1)}}$$

For n greater than 50, the values of K can be obtained using the asymptotic normality property of $\bar{X} + Ks$. With this approximation, K is given by

$$K = \frac{K_\alpha + \sqrt{K_\alpha^2 - ab}}{a}$$

where

$$a = 1 - \frac{K_\gamma^2}{2(n-1)}$$

$$b = K_\alpha^2 - \frac{K_\gamma^2}{n}$$

and K_α and K_γ (which equals $-K_{1-\gamma}$ so that $K_\gamma^2 = K^2_{1-\gamma}$) are the normal deviates corresponding to α and γ respectively, i.e.

$$\int_{K_\alpha}^{\infty} e^{-z^2/2} dz = \alpha$$

and

$$\int_{K_\gamma}^{\infty} e^{-z^2/2} dz = \gamma$$

Example

In the manufacture of forgings used as a terminal block at the end of an airplane wing span, the critical dimension was the lower limit of the slot width. In particular, it was desired that a single lower limit be specified above which it can be assured, with probability 0.95, that at least 99 percent of the slot widths will lie. A sample of 30 forgings were taken and the sample mean and standard deviation were found to be 0.8750 in. and 0.0015 in., respectively. Corresponding to n = 30, $\gamma = 0.95$ and $\alpha = 0.01$, a value of K = 3.064 is obtained from Table I. The required lower tolerance limit is given by

$$\bar{X} + Ks = 0.8750 - (3.064)(0.0015) = 0.8704 \text{ in.}$$

Construction of the Tables

For the case of a normal distribution with unknown parameters $\bar{X}'$ and σ', exact one-sided tolerance limits may be computed by the following procedure. Let $t_{n-1,\ \sqrt{n}K_\alpha}$ be a non-central t statistic with n−1 degrees of freedom and non-centrality parameter $\sqrt{n}K_\alpha$, where K_α is defined by

$$\frac{1}{\sqrt{2\pi}}\int_{K_\alpha}^{\infty} e^{-z^2/2} dz = \alpha$$

Determine t_0 such that $P\{t_{n-1,\ \sqrt{n}K_\alpha} > t_0\} = 1 - \gamma$. Let $K = t_0/\sqrt{n}$. If $\bar{X}$ and s are the sample mean and the sample standard deviation, respectively, based on a sample $X_1, X_2, \ldots, X_n$, i.e.,

$$\bar{X} = \frac{\Sigma X_i}{n};\quad s^2 = \frac{\Sigma(X_i - \bar{X})^2}{n-1}$$

then $\bar{X} + Ks$ and $\bar{X} - Ks$ are an upper one-sided tolerance limit and a lower one-sided tolerance limit, respectively. Thus, the probability is γ that at least a proportion $1-\alpha$ of the distribution will be less than $\bar{X} + Ks$ (or greater than $\bar{X} - Ks$).

The value t_0 may be obtained from tables of the distribution of the non-central t statistic. Such tables are those of Johnson & Welch[5] and Resnikoff and Lieberman[6]. The latter tables are perhaps more convenient for this application, and were used in the computation of Table I.

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Quality Control in the Electric Service Industry*

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It will be the object of this article to speak to the theme of the management viewpoint on the value of quality control with particular reference to the Commonwealth Edison Co., an electric service industry.

Probably not many people are seriously concerned about how an electric utility generates its power or transmits or distributes it. But all of us as individuals are very much concerned that when we flip the switch, the light will come on, or when we poke the plus bar of a computer, it will operate.

Many of us in the electric utility business have a similar attitude toward quality control. Even if we cannot follow the latest quality control theory, we are intensely interested if the method will bring results in the form of better electric service or reduction in cost of operation.

The foundation stone of America's industrial growth is mass production. Our rising standard of living depends on more goods for a given number of hours of labor. This, of course, calls for more production machinery. We in the electric power industry are vitally concerned because our job is to furnish the power for the machine. There is a surprising parallel between the use of electric power by industry and the Federal Reserve Board Index of Industrial Production. We are naturally proud that the use of our service is almost a measure of industrial progress.

What has all this to do with quality control? The skilled craftsman once boasted that no machine could equal his workmanship. This may be true, but the objective of mass production is a uniform product rapidly produced in great quantity and at low cost. The fact that great quantities must be produced makes quality control possible. To keep a product uniform and low in cost makes quality control essential.

Since quality control was first applied in product industries, there is a natural tendency to assume that the method is suitable only to those industries.

A little thought, however, reveals that utilities have been benefiting, indirectly, from the application of quality control to most of the equipment purchased. The electric power industry has about $4 of plant investment for each $1 of annual revenue. Any technique which improves the quality and cuts the cost of equipment benefits the industry, improves service to the customer, and keeps down the price of electricity. In addition, there must be ways that a service industry, with customers numbered in the millions, can make some direct use of these techniques.

I am not in a position to speak for the electric service industry as a whole, but the Commonwealth Edison Company, for one, has at least made a start in the use of quality control methods. Perhaps a few illustrations of some of the problems and the application of these methods to the solution of these problems will demonstrate the possibilities.

Power companies have used oil as an insulator and coolant in electrical equipment for over half a century. This is an excellent material but it has one serious drawback: it is combustible. As our equipment got larger and began to be installed in congested locations, we searched for a material which would be a good insulator and coolant, yet non-combustible. The manufacturers developed one and gave it the name *Askarel*. As with any new product, we sought data which would give, among other things, an indication of its strength as an insulator, its cooling properties, and its aging characteristic. A 10-year engineering research program was set up to collect and evaluate the necessary data. These data, when gathered, seemed to contain meaningless wide variations in values which defied evaluation.

At this point one of our quality control engineers was asked whether or not he could evaluate these data. Using the data already on hand, he was able to give us the specific answers we were seeking.* As a result, a specification limit was set for the

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*C. L. Matz, "An Application of Statistical Quality Control Techniques to Specification Requirements," *Industrial Quality Control*, Vol. IX, No. 1, July 1952, p. 13.

dielectric strength which is within the capability of the manufacturer's process to produce. As a matter of fact, the analysis showed that the manufacturer's process was capable of producing an insulating strength far better than he was aware. He had insisted that a specification limit in excess of 20,000 volts was impossible—when he was already meeting 26,000 volts.

Aging characteristics were also established. Furthermore, the analysis indicated reasons for apparently senseless variations in data. These variations stemmed from our test methods of handling Askarel. It follows that new procedures for making the tests were developed and are now used in our laboratories.

The value of the application of the quality control method here, I think, is obvious. First of all, it gave us some answers to an immediate problem. Second, it pointed rather clearly to the fact that it was possible to extract information from data that did not yield to ordinary methods of calculation.

Another good illustration of the use of quality control is the load factor method of loading transformers. It is not yet in full operation but is of some importance to the power business.

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The most common type of transformer reduces the voltage of the electricity to the proper value for use in homes. It generally looks like an iron box hung on a pole somewhere near the middle of the block. Commonwealth Edison has some 210,000 of these "iron boxes", and tries to install the smallest size which will carry the load in each location. In order to do this we must be able to know how much load is being carried and when the very peak load will occur. How can we determine this? The obvious way is to put a meter on every transformer and leave it there forever. However, this would be very expensive in terms of meters and manpower.

There has been an attempt to install alarm lights on transformers that would light up in the event of an overload. Here again the expense of having men ride up and down alleys looking for the lights is prohibitive, plus the fact that this is not a quantitative indication nor do we know when the overload occurred.

Another method, and this has been the company's practice, is to send men out at intervals to climb the poles and set recording meters. Then in a few days the men go back to read the meters and transfer them to other locations. Aside from the fact that such routine is costly, we cannot be certain that the period over which a given measurement was made coincides with the actual peak load the transformer carries.

A new development, just getting its first try, involves a technique called the "load factor method of measurement."

It is probably common knowledge that when the watthour meter in a home is read, the meter reader puts the reading on an IBM card. From this card and the one from the previous period, all the calculations are made by automatic machines to determine how many kilowatthours of electricity were used, and the amount of the bill. The bill itself is automatically prepared in card form. Normally each customer is supplied from a single transformer which also supplies several other customers. This circumstance provides an opportunity.

We are now beginning to apply a system of identifying the punch cards for the individual meters with the transformer serving them. Therefore, it will be possible to determine for each meter reading period, not only how many kilowatthours are used by each customer, but how many kilowatthours are supplied through a given transformer.

Here is where the quality control method begins. A scientifically designed sample, which represents the entire transformer plant, has been drawn. At each sample location meters are installed which will measure continuously the demand on the transformer and the kilowatthours supplied.

By quality control techniques, we expect to determine that for a certain class of customer or for a certain type of load, there will be a direct correlation between the number of kilowatthours used over a 60 day period and the instantaneous demand at the time of the heaviest load. The work is just getting under way but our belief is that on the whole this correlation will be far more accurate than the correlation between the true maximum load and the readings obtained by the old field check method.

The best part of the new system is that once it is set up, there will be an automatic check on the transformer loading every two months. Thus it will be possible to police the entire system continuously.

Sometimes several customers install major appliances such as ranges, air conditioners and the like before the engineers discover it. If the new system will avoid burnouts and interruptions from this cause, it will be a success.

This reminds me to digress a moment. When your utility requests information from you regarding installation of major appliances, it is not an attempt to insure that you get a larger bill, as I suspect some people feel. This information is needed to help guarantee that you have the proper amount of electricity to operate your appliance at all times. Let me cite a purely hypothetical but typical case using some numbers.

Let us say that 30 homes in a block are supplied by one transformer. If six of those homes were equipped for air conditioning in the spring nothing would happen at 70 degree temperatures, but the first humid 95 degree day would start all the cooling units at once. This heavy load might burn out a transformer or at least cause low voltage and poor service.

If the utility learns in advance, the transformer loading can be checked and the customers given better service.

But, back to the subject at hand, the transformer quality control program I outlined a few minutes ago is expensive. We estimate that to set up the first run will cost some half a million dollars. Further, it will require $20,000 a year to continue in

operation. Yet this $20,000 is substantially less than the cost to patrol the transformers and either read instruments or look for little alarm lights on the transformer which light up in the event of overload.

The most important benefit, of course, is a better utilization of transformer capacity. The present total investment in these simple looking boxes is about $50,000,000. If more efficient use of these transformers reduces the investment needed by only one or two percent, the cost of the project is recovered.

Another important item of our electrical physical plant is high voltage insulators. These innocent appearing pieces of porcelain that are hung on every transmission tower are numerous and each one must be in perfect condition to keep the lights burning. If you see the number in each string hanging from tall steel transmission line towers you might guess that we buy them by the carload. We do. A test on every insulator would be prohibitively expensive. It once was the practice to send an inspector to the manufacturer's plant to witness destructive tests on six to ten insulators per carload. Obviously, such sampling could not be expected to be wholly satisfactory.

Today, we ask the manufacturer to supply us with test data from his process for analysis by quality control methods. From this, we are able to determine the minimum mechanical and electrical strength of his insulator. If this calculated minimum is consistently above our lower specification limit, the insulators from the given lot are accepted without further test.

How much this plan saves in dollars, I don't know. I do know that it has been possible to assure that the insulators bought are of uniform quality and will stand the test of time. This means against the ravages of nature, not a boy with a rifle.

These are samples of what quality control can do in a service industry to help improve service and cut costs to stem the rising tide of inflation. There are many and probably better opportunities to apply these modern techniques.

What about:

Sampling and analyzing the 35,000 tons of coal we burn each day?

Analyzing slag and fly ash?

Material inspection?

Much of this activity is in its infancy. We expect to seek out further applications. Commonwealth Edison has nearly 2,000,000 customers and each has one thing in common with the other: they all buy and use electricity. There are many things that the quality control methods of analysis should be able to tell us about the habits of these customers —things that can be extremely useful in meeting their needs for service. Last summer, for instance, the customers demanded 600,000 kilowatts more power on a 90 degree day than on a 70 degree day. Could this have been predicted. What will the figure be next year?

The watthour meter on every house is tested for accuracy at fixed intervals. A study is under way to see if the quality control technique in place of the fixed interval will save money and assure the customer of accurate measure.

The use of electricity has been doubling every 10 to 12 years. This will continue only if service continues to be reliable and economical. Up to now, the battle against inflation has been won by ever bigger, increasingly efficient machines that cost less per unit of capacity. This can't go on forever—in fact, we have reached the point where we can expect little help from that quarter.

You in the field of quality control are doing work of growing importance to all industry. Top management needs to consider its value and the opportunities. In the electric service industry we are just beginning. We have high hopes that this new tool will be a big help toward improved service, lower costs and reasonable rates.

Low Cost Multiple Sampling

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Introduction

Most quality control people recognize that the inspection function is an extremely important phase in the control of quality of a manufactured product. The costs of this inspection should not be overlooked as it is a major expense item of the manufacturing budget. All industry is striving for higher quality and more reliable products at greatly reduced manufacturing costs. One of the most important dollar saving methods available to industry today is the use of statistical quality control in the inspection phases of manufacturing.

It is frequently possible to reduce inspection costs without jeopardizing the quality of the product. Statisticians and mathematicians have developed techniques of single, double and multiple sampling plans which have effectively reduced inspection costs. The most popular source of these plans today is MIL-STD-105A.

The purpose of this article is to suggest a new method for using the less expensive multiple sampling inspection technique at a lower administrative cost than heretofore has been developed.

Conventional Multiple Sampling

Conventional multiple sampling as explained in most texts and as practiced by users of MIL-STD-105A is the sampling of a lot and determining if the sample has any defects. If it has less than a predetermined number—the acceptance number—the lot can be accepted. If the lot has more than the rejection number, the lot is summarily rejected. However, if the number of defects falls between the acceptance number and the reject numbers then the inspector must take another sample of the same size as the first. The cumulative results of all such samples inspected are compared with other predetermined acceptance and rejection numbers. This process is continued until a decision to accept or reject is reached. Most plans truncate this series of sample taking before all units in the lot are inspected. An example of one such sampling plan from MIL-STD-105A is illustrated in Table I.

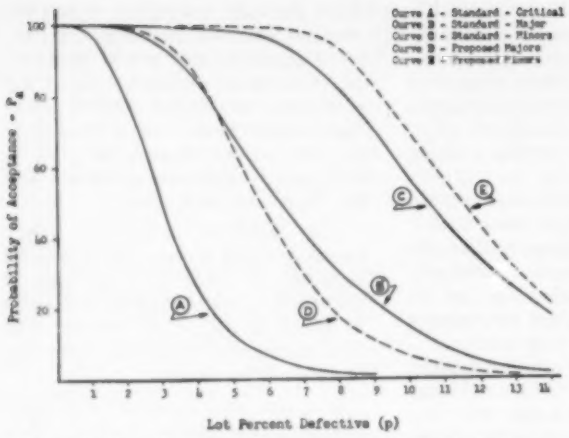

Figure 1—Operating Characteristic Curves For Double Sampling Plans Letter Size K Level II

Administrative Problems Encountered

As is generally known, multiple sampling, on the average, requires the fewest number of units in a lot to be inspected in order to make an accept or reject decision while maintaining the assigned quality level. However, as many have learned, the administration of a multiple sampling program is expensive, time consuming and can often fail to reduce costs because of some costly administrative procedures. Some of the administrative problems to be solved are: the optimum amount and the least cost method for recording inspection data; the amount of time required to supervise the program; the optimum means of giving the inspector standardized inspection instructions, list of tools to use and tests to perform; the most effective way to advise other related activities (purchasing, engineering, etc.) what methods are to be used in the inspection function and to what severity level the part will be subjected in order to be accepted.

At RCA we have developed, and are using, a workable administrative program that has minimized cost and the problems outlined above.* One of the main phases of this program is the adoption of MIL-STD-105A sampling plans in conjunction with a classification of defects program. Inspection instructions carry the information needed to various activities requiring the data.

In the past the classifying of defects resulted in an AQL assignment for each characterististic. This is proper and in accordance with current practices. However, the cost of selecting different samples, inspecting different quantities for different characteristics, and recording the results for each characteristic was overwhelming. A study was undertaken to investigate the possibilities of reducing these costs without sacrificing quality or altering producer and consumer risks. The results of these studies and the experience gained from using the resultant program motivated the presentation of this article.

Multiple Sampling Proposal

An analysis of typical defect classifications on many common components revealed that in general the inspection analyst assigned the critical defects to the lowest AQL plan for that part. Then in turn the majors and minors were assigned not the next higher AQL but the second higher AQL and the fourth higher AQL. For example: Criticals were assigned 1.0 percent AQL, Majors 2.5 percent AQL and Minors 6.5 percent AQL. This was not a hard and fast rule but the pattern was significant.

During further discussions we found that standard weighting factors could be employed with little or no effect on the quality level but a significant reduction in inspection costs. We assigned one critical defect to each rejection or acceptance number as defined in MIL-STD-105A, two major defects to each rejection or acceptance number, four minor defects, and a combination of one major and two minor defects, to each rejection and acceptance number. Using the AQL usually assigned to the critical defects we would not alter risks or quality levels to any great extent. Referring to any plan, if the acceptance number in the applicable plan is one and the rejection number two, we would be in a position to accept the lot if there were one critical defect, or three majors or seven minor defects or a combination of one major and five minors or an appropriate combination not adding up to the reject number. It is almost obvious that this suggested weighting ratio allows more minor defects in the plant than we would normally like, but, as it usually happens, minor defects are accepted, waived, or corrected at a later date, all because production must continue. A defect should be considered minor in importance relative to the manufacturing schedule—if it can be fixed later.

The cost of sorting later, if it becomes necessary, should be more than offset by the savings in the incoming inspection function.

Theoretical Justification

In order to illustrate the justification of the proposal, we have selected a typical lot size of 1000 units, Level II of MIL-STD-105A (Code letter K) for the basis of our discussion (see Table I). Using Molina's* tables, the probability of accepting a lot with varying degrees of fraction defective were calculated for each combination discussed previously; the operating characteristic curves are illustrated in Fig. 1. A double sampling plan is used to illustrate the theory so as to reduce the volume of statistics that would otherwise be presented. The proposal holds, however, for any of the MIL-STD-105A sampling plans.

A sample calculation is presented to illustrate the method used in developing the OC curves.

first sample size $N_1 = 75$
second sample size $N_2 = 150$
AQL = 1.0% double sampling Plan

*E. C. Molina, *Poisson's Exponential Binomial Limit*, D. Van Nostrand Co., Inc., c1947.

TABLE I—MIL-STD-105A Sampling Plan

Letter K Lot Size 801 to 1300		MIL-STD-105A			Level II AQL 1.0%
Type of Sampling	Sample No.	Sample Size	Total Sample	Acc. #	Rej. #
Double	1st	75	75	1	6
	2nd	150	225	5	6
Multiple	1st	30	30	*	3
	2nd	30	60	0	3
	3rd	30	90	1	4
	4th	30	120	2	6
	5th	30	150	3	6
	6th	30	180	5	7
	7th	30	210	6	7

*Acceptance not permitted until the 2nd sample has been inspected.

*"A Low Cost Sampling Method" by R. M. Jacobs details the solution to these problems. The complete paper was presented and appears in the Proceedings of the *Third National Symposium on Reliability and Quality Control*, January 14, 15, 16, 1957 (available from the National office of ASQC, see ASQC Stock LIST, IBC); the administrative details were republished in the Feb. 11, 1957 issue of *American Machinist* and in the May 1957 issue of *Production*.

first acceptance number = 1

second acceptance number = 5

The Probability of accepting (P_a) a lot one percent defective (P) using a random sample is found by adding the probabilities (P) of each combination of occurrences.

P of 1 defect or less on first sample	= 0.8265
P of 2 defects on first sample times P of 3 defects or less on second	= 0.1240
P of 3 defects on first sample times P of 2 defects or less on second	= 0.0273
P of 4 defects on first sample times P of 1 defect or less on second	= 0.0035
P of 5 defects on first sample times P of 0 defects or less on second	= 0.0002
	0.9815

Curve A represents the standard 1.0 percent AQL Plan of MIL-STD-105A which in our hypothetical case is assigned to critical defects.

Curve B represents the standard 2.5 percent AQL Plan assigned for major defects.

Curve C represents the standard 6.5 percent AQL Plan assigned for minor defects.

Curve D represents our proposed plan for majors when they are equal to one half a reject number.

Curve E represents our proposed plan for minor defects when they are equal to one quarter of a reject number.

It can be seen from Fig. 1 that the proposed plan follows very closely those of MIL-STD-105A and that even though our minor plan will accept defectives more readily, it is generally in keeping with QC procedures of accepting minor defects when production will not be hampered and the operational aspects of the equipment will not be affected.

Summary

This article has attempted to present a proposal for reducing the administrative costs of using low cost multiple sampling techniques without altering to any great extent the consumer and producer risks.

The proposed system, utilizing the combined sampling plans for critical, major and minor defects has the same degree of success for any combination of selected AQL values for the three classifications as long as they are two steps apart as illustrated.

The weighting factors, as proposed, permit the use of one sampling plan per component and the total number of defects is a summation of the proportionate values of each defect found. This summation, when compared with the acceptance and rejection number in the sampling plan determines acceptance or rejection of the lot.

It also allows the manager to more readily stabilize his inspection load as the size of samples per lot would not be indeterminate. They would be more constant and scheduling becomes another cost saving feature. Thus the ratio of one critical, two majors or four minors for each rejection or acceptance number allowed was evaluated and found to be economically feasible. A multiple sampling plan complete with accompanying instructions on the face of the plan is illustrated in Table II.

The method described has been successfully used in three major industries and in about ten companies for the past eight years. It has been accepted by some inspection services of the Government as fulfilling the quality control requirements of incoming inspection operations.

TABLE II

MULTIPLE SAMPLE PLAN

RCA Victor Division
EPD Quality Control Section

2.5% A.Q.L.
Issued: January 1, 1955

		SAMPLE NUMBER																				
	Sample	1			2			3			4			5			6			7		
Lot Size	Size	TS	A	R	TS	A	R	TS	A	R	TS	A	R	TS	A	R	TS	A	R	TS	A	R
0-65	10	10	0	1																		
66-180	7	21	0	2	28	1	3	35	2	4	42	3	4									
181-300	10	20	0	3	30	1	3	40	1	4	50	2	4	60	2	4	70	4	5			
301-500	14	28	0	3	42	1	4	56	3	5	70	3	5	84	3	5	98	4	5			
501-800	20	40	1	4	60	2	5	80	3	6	100	5	7	120	6	8	140	7	8			
801-1300	30	30	0	4	60	2	5	90	3	8	120	4	9	150	6	10	180	8	12	210	11	12
1301-3200	40	40	0	4	80	2	7	120	5	9	160	7	11	200	9	13	240	11	15	280	15	16
3201-8000	50	50	0	5	100	3	8	150	5	11	200	8	13	250	10	15	300	13	17	350	18	19
over 8001	75	75	1	7	150	4	10	225	8	14	300	12	18	375	15	21	450	18	25	525	24	25

INSTRUCTIONS FOR USING SAMPLING PLAN

Sample Size - each succeeding sample is this size.
TS - Total Sample Taken
A - At this number of defects or Below -- ACCEPT the lot. (Acceptance Number)
R - At this number of defects or Above -- REJECT the lot. (Rejection Number)
If the number of defects falls between A and R -- Take another Sample.
Samples MUST be extracted in as near equal numbers as possible from all boxes or cartons in each shipment making up the lot. When the box is packed in layers the samples must be taken equally from each layer.

SUPERVISOR'S CIRCLE

PAUL A. ROBERT, *Editor*

Precision Products Co. of Cincinnati, Box 130, Norwood 12, Ohio

The OQL Assurance System Used at Bay State

J. R. GILMAN

Bay State Abrasive Products Company, Westboro, Mass.

Generally accepted as a truism in industry has been the belief that you cannot put final product inspection under normal production incentive without affecting the outgoing quality adversely. At Bay State we have disproved this long accepted theory and in so doing have increased the productivity of our inspectors while simultaneously increasing our average outgoing quality level (OQL).

The key to this double barreled improvement is a check inspection system which is tied in with a weekly OQL rating for every final inspection line. With this system in effect during the past two years we have been able to increase the volume of work output by over 20 percent and improved our factory OQL from 95.8 percent to 97.3 percent, a 36 percent reduction in defectives being shipped, with no increase in unit inspection costs.

At Bay State, final inspectors are on a straight percentage incentive—that is if a man inspects 25 percent more pieces than the time study rate calls for, he receives a 25 percent bonus on his base rate; 50 percent more output calls for a 50 percent pay bonus, etc. These inspectors are production personnel reporting to production foremen.

There are nine inspection lines at Bay State where orders are given final inspection. The Quality Control Department provides the sampling plans, physical tolerances, and disposition procedure standards used by the inspectors. Those orders which have passed final inspection are sampled randomly by a roving check inspector assigned to the Quality Control Department. This inspector, using the same sampling plans and standards as the production inspector, tests the sampled goods as though he were a customer receiving these items. The results of his tests are recorded and demerits are assigned in accordance with the "Rules for Determining Out-Going Quality Level" (see Appendix).

In addition to recording the results of his inspection, the check inspector also brings all defects observed to the attention of the production foreman concerned for any on-the-spot action that might be indicated. The foreman discusses the problem with the responsible production inspector to determine the reason for the defective material being passed as okay, and to arrange for any changes if necessary to prevent recurrence of the error. Under no conditions does the check inspector discuss his findings directly with the production inspectors.

The results of each week's check inspection are published factory-wide in charts showing the OQL ratings for:

1. The factory average for all the weeks in the year to date (Fig. 1).
2. Each final inspection line as compared to all the other lines for the current week (Fig. 2).
3. Each final inspection line for all the weeks of the year to date (Fig. 3).

In addition, the charts for the individual lines and the factory average have a line drawn on them showing the average OQL for the two previous years. A defect analy-

EDITOR'S COMMENTS

The Editor has been asked on occasion "can inspectors be put on incentive pay." Here is a shop that is doing it by having a check inspector sample inspect the work of the inspectors. This seems to be the most successful way of applying incentive pay to the inspectors job.

The plan is tailored to the job without statistical validation of risks, etc., but appears to be successful because it attempts to objectively measure quality and by focusing attention on the quality performance of the production organization gets corrective action started.

These are probably the most essential features of a successful quality control plan.

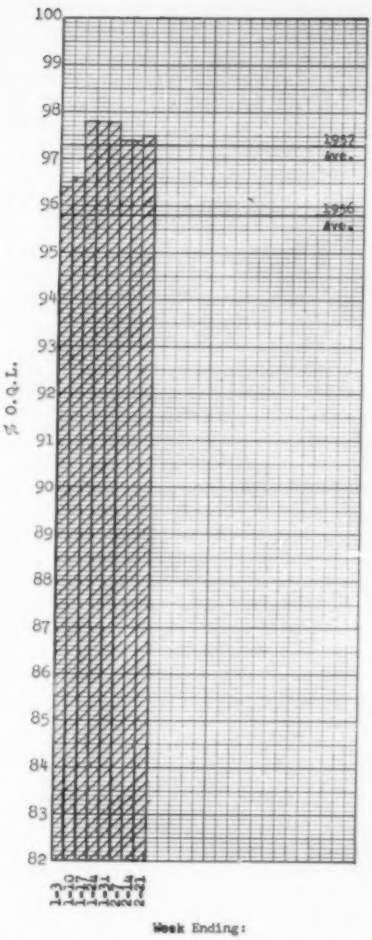

Figure 1—Factory Outgoing Quality Level (OQL)

sis sheet (see Fig. 4) accompanies the OQL chart for each line, listing the reasons for the assigned demerits and the calculation by which the rating was determined.

These charts are the subject of intense interest to all concerned. Inspection personnel learn from them how their performance compares with other inspectors. Management has a quality assurance rating for evaluating factory performance. And the Quality Control Department has a guide to help them find weak spots where they should put their efforts to improve our outgoing quality level.

Since the check inspector covers all inspection lines, he obviously can sample only a small fraction of the orders from any one line each week. However, during the course of a year the sum total of his samples adds up to a number which is more than adequate for representing the performance of a specific inspection line. For instance, Line #1 may inspect 1,000 orders per week of which the check inspector reviews about 50. In the course of a year, this means he reviews well over 2,000 orders from Line #1, a quantity which is most reliable for purposes of quality evaluation.

Due to the fact that in any given week, the check inspector may happen to obtain a non-representative series of orders coming from a line which could result in an undeservedly low rating for that line, major corrective action is not usually initiated as the result of an individual week's rating. However, any trend as indicated by three or four weeks of successively lower OQL ratings, are readily observed. This will call for action by the chief inspector, working in conjunction with the general foreman of the inspection lines and the foreman of the particular line involved, to determine and eliminate any basic causes for such a trend.

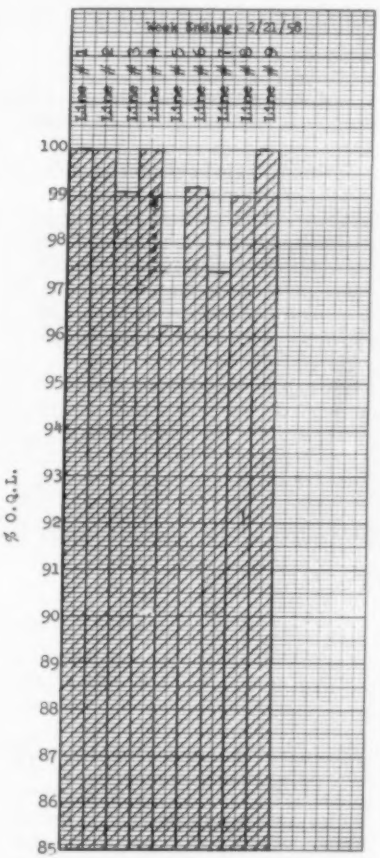

Figure 2—Relative Outgoing Quality for all Finishing Lines

With these charts as guides, we have been able to make many improvements which have resulted in continued improvement in outgoing quality with very little added cost. Some of the things which we have discovered directly as a result of the OQL charts have been inspectors with poor eyesight, inspectors who did not know how to use their equipment properly, poor equipment, and poorly written instructions.

That this system works to provide adequate quality assurance is attested to by our salesmen in the field. Every six months they are requested to send in reports on our product quality as indicated by customer satisfaction in comparison with competition. Since the inception of the OQL rating system, these reports have shown a steadily increasing satisfaction with our product quality as it reaches them.

As a final testimonial, however, I would like to quote a statement made by our manager of industrial engineering at a meeting on factory costs. He complained, "We cannot keep those inspectors' minds on costs because of that darn OQL chart. They are so scared of getting a de-

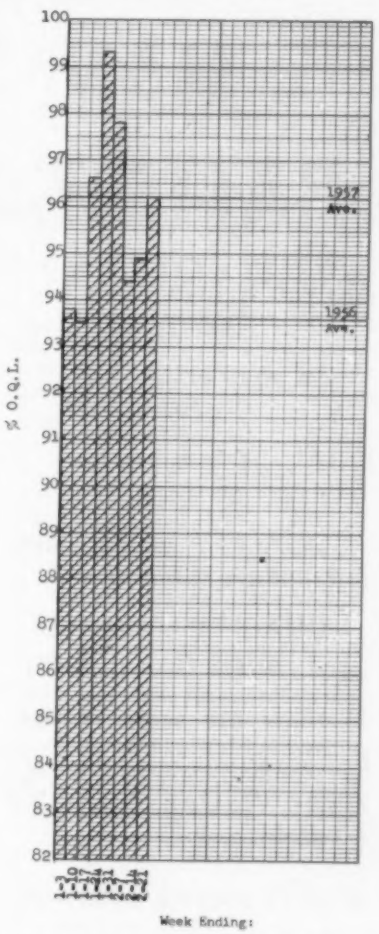

Figure 3—Relative Outgoing Quality for Line #5

ONE MAN BATTLE?

Are you fighting for Quality all alone?

Do your employees think that:

QUALITY is a matter of inspection?

QUALITY is important but not on their jobs?

QUALITY is someone else's responsibiilty?

IF these are some of your plant problems then you will be vitally interested in the Elliott VISUAL QUALITY Program.

ELLIOTT SERVICE COMPANY, INC.
Mount Vernon, New York
(see opposite page ➔)

Bay State Abrasive Products Company—
Defects Analysis Report

Report on: Line #5

Week Ending: 2/21/58

Total Number of Orders Checked	70
Potential Demerit Value	210

Major Defects	Demerit Value
1-Marking-7S-"Mount Out" marked on wrong side of wheel	3
1-Truth-7S-Runout on side	3
Minor Defects	
1-Marking-9R-Not marked according to Standard Practice	1
1-Visual-1B-Corners chipped	1
Total Demerits	8

$$OQL = 100 - \left(\frac{8}{210} \times 100\right) \qquad 96.2\%$$

Figure 4—Typical Defect Analysis Sheet

merit that they won't think of anything else."

Appendix—Rules for Determining Outgoing Quality Level

The Outgoing Quality Level (OQL) Chart indicates the general level of quality of the products being shipped. This is determined as follows:

1. Demerits are assigned by the roving check inspector to the major and minor defects which he finds in random samples of material coming through the inspection lines. Major defects are those for which the order should have been rejected. Minor defects represent poor quality, although not bad enough to require rejection of the order. The demerit values for each type defect are:

	Demerit Value
Major Defect	3 points
Minor Defect	1 point

2. Each order sampled has a potential demerit value of 3 points for each property checked. If more than one property is checked on a single order, the order is assigned 3 potential demerit points for each property checked and is considered the same as a series of orders each checked for one property. For example, one order of wheels which is checked for balance, thickness, and hole size is considered the same as 3 orders with a total potential demerit value of 9 points.
3. In any one order no more than 3 demerits may be assigned for a major defect in a given property, no matter how many wheels show that major defect. Also, only 1 demerit may be assigned for a minor defect, no matter how many wheels have that minor defect. If both major and minor defects are found in the same property, the demerits assigned will be 3 points.

4. At the end of each week tne total demerits and total potential demerit values of all orders check inspected are determined. The OQL is then calculated by the following formula:

$$OQL = 100 - \frac{(\text{Tot. Dem.})}{(\text{Tot. Pot. Dem.})} \times 100$$

A theoretical example of the above procedure is given for Inspection Line #5. During the week the check inspector tested 50 orders. In 3 orders he found major defects, and there were minor defects in 6 more orders.

Major Defects
demerits $= 3 \times 3 = 9$
Minor Defects
demerits $= 6 \times 1 = 6$

Total 15

Total Potential
Demerits $50 \times 3 = 150$

$$OQL = 100 - \left(\frac{15}{150} \times 100\right)$$
$$= 90\%$$

SECOND STUDENT BRANCH GRANTED CHARTER

Wentworth Student Branch of Wentworth Institute, Boston, Mass., became the first New England school to establish a student branch of the Society. Twenty-three Wentworth students became charter members at the group's first meeting.

Society President Leon Bass announced the appointment of Carl W. Nickerson as counselor of the student branch which is the second such branch to be granted a charter by the Society. Mr. Nickerson is an electrical engineering technology power option instructor at Wentworth Institute. His plans for the growth of this student branch are still in the tentative stages, but inasmuch as he undertook the organization of the group completely on his own initiative, there is little doubt that, with his further efforts and student enthusiasm, the Wentworth Student Branch will be a tremendous success.

Officers and sponsors of the branch are: John Emmott, president; John Ficco, vice president; Alfred Sanville, secretary; Carl W. Nickerson and Ralph W. Johnson, faculty advisors. The Boston section of the Society aided in the group's organization and was represented by section member William Spang at the group's first meeting.

AROUSE INTEREST!

SECURE COOPERATION!

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EMPLOYEE RESPONSE, however, can range from passive resistance to enthusiastic participation. And the stakes are high!

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ROUND THE CLOCK support for your Quality objectives could begin with your request for more detailed information on the coupon below.

Elliott Service Company, Inc., Mount Vernon, New York

Elliott Service Company, Inc.
Department 84,
Mount Vernon, N. Y.

Please provide me, without obligation, further information and multi-color samples of your Visual Quality Program.

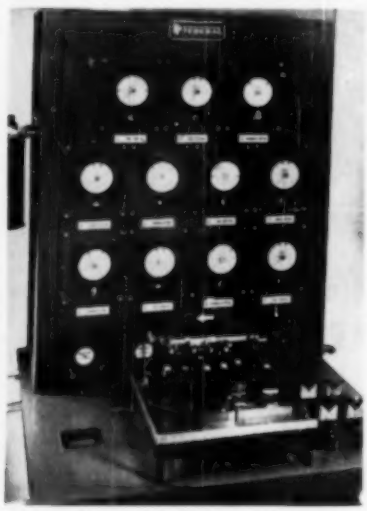
Firm _____
Name _____
Address _____
City _____ Zone _____ State _____

What's New?

ROY A. WYLIE, *Editor*

When inquiring about "What's New?" items, please mention INDUSTRIAL QUALITY CONTROL

Federal Products Corp., 1144 Eddy Street, Providence, R. I., has developed a Modular Air-Electric meter switch that greatly speeds the measuring of multiple dimensions. Ordinarily a multiple dimension gage requires the operator to select and classify each part according to its dimensional conformance. This may lead to error, especially on borderline decisions. The Modular Air-Electric Unit eliminates these errors by making the decisions for the operator. When several of these new Modular Units are assembled for measuring multiple dimensions si-



multaneously, they are arranged so that the operator does not have to observe several bobbins or dials and decide whether or not every one falls into the acceptable zone. The operator need observe only one large signal light which, when on, indicates ALL dimensions are within tolerance. In addition, each of the individual meter units contained in the gage is equipped with two lights which signal an off-size dimension—red for scrap, yellow for salvage. By glancing at a meter hand, the operator can see exactly how much the off-size dimension deviates from tolerance. The gage illustrated employs eleven Air-Electric Modular Units to check eleven separate dimensions on a compressor crankshaft and is capable of measuring up to 800 pieces per hour. The Modular construction of the meter-switch units enables the gage to provide continuous service with no lengthy shut-downs for gage repair or adjustment; it can be replaced within a few minutes by a spare meter so that the gage can continue to operate. There are only four screws, two finger-tight air hose connections, and one Amphenol electric connector involved in the exchange. Each gaging unit contains its own independent zero setting mechanism so that a new one can be put into the gage and set up without disturbing those already set for gaging.

★ ★ ★

Industrial Control Co., 805 Albin Avenue, Lindenhurst, Long Island, N. Y., has announced the model 105-AR servo tester, the latest addition to the company's line of servo test equipment. It is a stable sine generator designed for the automatic frequency response measurements of servo systems and associated components. It features remote control of data frequency, quadrature outputs, and is built to fit into a 19-inch rack with a panel height of 8¾ inches. The instrument covers a data frequency range from 0.3 to 80 cps, with different ranges available on special order. This data frequency can be set either by a front panel knob, or remotely controlled by some external DC voltage. Four suppressed carrier 400 cps output voltages are available in two quadrature pairs. The data phase of the first pair is fixed, while that of the second pair is set by a front panel dial. Controls are provided for output amplitude, data phase and frequency and the instrument operates from the 60 cps line. Typical applications of the 105-AR are automatic laboratory transfer function measurements, production line tests and field maintenance of automatic control equipment.

★ ★ ★

An AccuRay Density System which measures and/or controls fluid density, specific gravity, percent solids, or related quantity has been announced by **Industrial Nucleonics Corp.**, 1205 Chesapeake Avenue, Columbus 12, Ohio. This new density unit is applicable to liquids, slurries, and flaked, granulated, powdered, or other divided solids. Based on the principles of gamma ray transmission from a radioscope, the system makes no physical contact with the flowing material. Measurements are also independent of flow rate and pressure. Long term accuracies of −0.001 to −0.003 specific gravity are readily obtainable, depending upon the process and material measured. The system can be furnished with sensitivities to the order of 0.001 specific gravity. Built-in standardizing circuits maintain accuracy and calibration, and any component, except radiation source or detector, can be replaced without affecting calibration. Also available is an automatic built-in compensation for changes in density of measured material due to changes in its temperature. The measuring head of the AccuRay Density System is constructed of heavy corrosion resistant meehanite castings welded on a section of pipe. Pipe sizes from 3 to 8 inches are standard; other sizes are available on special order. The power-supply-amplifier instrument is in specially designed panel-mounted enclosure with locking control-access door, slide-out electronic unit, and modular chassis arrangement for ease of maintenance. The instrument may be located hundreds of feet from the measuring head. Any one of several standard recorders may be used with the AccuRay System.

★ ★ ★

The new OPTO-TOOLING-AUTO-COLLIMATOR, has been introduced by the **George Scherr Co.**, 200 Lafayette Street, New York 12, N. Y. The OPTO-TOOLING-AUTO-COLLIMATOR eliminates the need for sine bars, tables of sines and involved calculations previously necessary to establish angles. Testing surface flatness of machine beds, checking squareness of surfaces measuring alignment of centers and squareness of axis to ways, testing angles on jigs and fixtures, checking straightness of bores, checking faces for parallelism, optical instrument assembly alignment are just a few of the many

(Continued on page 25)

ASQC CONVENTIONS

12th Annual Convention • May 26, 27, 28 • 1958 • Boston, Mass.

Committee Meetings Schedule

(All meetings at Hotel Statler)

TIME	*DATE & MEETING*	*ROOM*
	SUNDAY, MAY 25	
10:00 am	General Technical Council	406-8
2:00 pm	Electronics Division Technical Publications	404
8:00 pm	Committee on Professionalism	410
	MONDAY, MAY 26	
3:00 pm	Meeting	
	Examining Committee	419
	Membership Committee	410
	Saddoris Award Committee	408
	Auditing Committee	406
	International Cooperation Committee	404
4:00 pm	Operations Research Committee (Tech. Session)	
4:40 pm	ANNUAL MEETING OF THE SOCIETY	BAY STATE
6:30 pm	Dinner and Annual Meeting	
	Administrative Applications Division	
	Aircraft Division	
	Automotive Division	
	Chemical Division	
	Electronics Division	
	Textile Division	
	Metals Technical Committee	
7:30 pm	Meeting	
	All Section Officers	BAY STATE
9:00 pm	SOCIAL EVENING	Ball Room Sheraton-Plaza Hotel
	TUESDAY, MAY 27	
7:30 am	Breakfast	
	General Technical Council	406-8
9:00 am	Meeting	
	Division & Technical Committee Chairman	406
	Professional Committee Chairman	408
	Applied Methodology Committee	419
	Constitution & By-Laws Committee	410
	District Representatives	404
	Publicity & Promotion Committee	402
3:00 pm	Meeting	
	"New" BOARD OF DIRECTORS	419
	Standards Committee	410
	Bibliography Committee	408
	Awards Committee	406
	Program & Speakers Committee	404
	Vendor-Vendee Relations Committee	402
6:30 pm	ANNUAL BANQUET	Ball Room Sheraton-Plaza Hotel
9:30 pm	Meeting	
	Editorial Board	419
	Financial Advisory Committee	W. R. W.
	WEDNESDAY, MAY 28	
9:00 am	Meeting	
	Conferences Committee	419
	Professional Ethics Committee	410
	Cleveland Convention Technical Program Committee	408-6
	Professional Relations Committee	404
	Education & Training Committee	402
2:30 pm	"Old" BOARD OF DIRECTORS	419
	THURSDAY, MAY 29	
9:00 am	Meeting	
	1958-59 Executive & Operating Committee	419
	General Convention Committee	Parlor C

TWELFTH ANNUAL CO

MAY 26,

	PERIOD I—MONDAY A.M. 10:30-11:30	PERIOD II—MONDAY P.M. 3:00-4:00	PERIOD III—TUESDAY A.M. 9:00-10:00, 10:30-11:3
A	**GENERAL INTEREST** **Speaker:** PAUL C. CLIFFORD, State Teachers College, Montclair, New Jersey **Subject:** **"Control Charts Without Calculation—Some Modifications and Some Extensions"** **Moderator:** MASON E. WESCOTT, Rutgers University, New Brunswick, New Jersey	**GENERAL INTEREST** **Speaker:** CHARLES A. REED, General Electric Company, Ashland, Massachusetts **Subject:** **"Measuring Visual Characteristics"** **Moderator:** AFTON F. BEZANSON, Gillette Safety Razor Company, Boston, Mass.	**GENERAL INTEREST** **Speaker:** WILLARD ALLPHIN, Sylvania Electr Products, Inc., Salem, Mass. **Subject:** **"Lighting for Inspection" (What D You Want Your Inspectors To See?)** **Moderator:** R. B. BROWN, JR., Boston Edison Com pany, Boston, Massachusetts **Speaker:** WILLIAM H. PERKS, Norton Compan Worcester, Massachusetts **Subject:** **"Budgeting Rejections"** **Moderator:** CHARLES J. HUDSON, Consultant, We Boylston, Massachusetts
B	**OPERATIONS RESEARCH** **Speakers:** WILLIAM E. ANDRUS, JR., and MARTIN SCHATZOFF, IBM Corporation, Endicott, New York **Subject:** **"Computer Simulation of Statistical Character Recognition Logic"** **Moderator:** DOUGLAS H. W. ALLEN, American Iron & Steel Institute, New York, N. Y.	**OPERATIONS RESEARCH and TEXTILE** **Speaker:** R. W. LINDSAY, American Enka Corporation, Enka, North Carolina **Subject:** **"The Use of Quality Control Techniques in Operations Research"** **Moderator:** JAMES B. CURLEY, American Viscose Corporation, Marcus Hook, Pa.	**ADMINISTRATIVE APPLICATIONS** **Speaker:** GRANT I. BUTTERBAUGH, Universit of Washington, Seattle, Washington **Subject:** **"Applications of Statistical Methods i Business Administration"** **Moderator:** HOWARD L. JONES, Illinois Bell Tele phone Company, Chicago, Illinois **Speaker:** LLOYD A. KNOWLER, State Universit of Iowa, Iowa City, Iowa **Subject:** **"Clerical Application of Statisti Methods"** **Moderator:** WARREN R. PURCELL, Raytheon Manu facturing Co., Lowell, Mass.
C	**ELECTRONICS** **Speaker:** BORIS J. KINSBURG, Bell Telephone Laboratories, Murray Hill, N. J. **Subject:** **"Distribution Requirement Specification"** **Moderator:** BERNARD P. GOLDSMITH, Raytheon Manufacturing Co., Newton, Mass.	**ELECTRONICS** **Speaker:** GEORGE P. LEWETT, Western Electric Company, Kearny, New Jersey **Subject:** **"Quality Control in the Manufacture of Large Wired Equipment"** **Moderator:** AUGUST B. MUNDEL, Sonotone Corporation, Elmsford, New York	**BREWING** **Panel:** HILARY B. MATTINGLY, American C Company, Chicago, Illinois E. P. HOKANSON, Blatz Brewing Com pany, Milwaukee, Wisconsin ROY LACEY, Ladish Malting Company Milwaukee, Wisconsin WILLIAM H. von MEYER, Barry Wehmiller Machine Co., St. Louis, Mo WILLIAM McKENNEY, P. Ballantine & Sons, Newark, New Jersey **Subject:** **"Statistical Quality Control Applica tions in Brewing and Allied Industries"** **Moderator:** JOHN S. RANDALL, Anheuser-Busch Inc., St. Louis, Missouri
D	**AIRCRAFT** **Speaker:** H. COHEN, The Martin Company, Baltimore, Maryland **Subject:** **"Project Vanguard—A Report on Progress"** **Moderator:** JAMES L. COBURN, Convair, Fort Worth, Texas	**AIRCRAFT** **Speaker:** PAUL E. ALLEN, Beech Aircraft Corporation, Wichita, Kansas **Subject:** **"Research in the Field of Product Quality Control"** **Moderator:** JAMES L. COBURN, Convair, Fort Worth, Texas	**AIRCRAFT** **Speaker:** A. L. LAMBERT, The Martin Company Baltimore, Maryland **Subject:** **"Reliability—a Role for Quality"** **Speaker:** THOMAS A. BUDNE, Rath & Strong Boston, Massachusetts **Subject:** **"Make SQC More Effective"** **Moderator:** JOHN L. KIDWELL, The Martin Com pany, Orlando, Florida
E	**EDUCATION** **Speaker:** GAYLE W. McELRATH, University of Minnesota, Minneapolis, Minnesota **Subject:** **"Significance Tests I: Normal Models"** **Moderator:** JOSEPH MOVSHIN, Thompson Products, Inc., Manchester, Missouri	**EDUCATION** **Speaker:** MAX ASTRACHAN, USAF Institute of Technology, Wright-Patterson Air Force Base, Ohio **Subject:** **"Significance Tests II: Small Samples"** **Moderator:** RUDOLPH FREEDMAN, Alco Valve Company, St. Louis, Missouri	**EDUCATION** **Speaker:** FRED C. LEONE, Case Institute o Technology, Cleveland, Ohio **Subject:** **"Significance Tests III: Variances"** **Moderator:** CECIL CRAIG, University of Michigan Ann Arbor, Michigan **Speaker:** ROBERT W. BOEKE, John Deere, Ottum wa, Iowa **Subject:** **"Significance Tests IV: Confidence Intervals"** **Moderator:** DAVID S. CHAMBERS, University o Tennessee, Knoxville, Tennessee
F	**CHEMICAL** **Speaker:** GEORGE E. P. BOX, Princeton University, Princeton, New Jersey **Subject:** **"Evolutionary Operation"** **Moderator:** MAYNARD S. RENNER, Dewey & Almy Chemical Co., Cambridge, Mass.	**CHEMICAL** **Speaker:** NORMAN F. KNOWLDEN, American Cyanamid Company, Pearl River, N. Y. **Subject:** **"Compensating for Systematic Effects Detected by an Analysis of Covariance in a Microbiological Assay"** **Moderator:** PAUL K. LEATHERMAN, Mallinckrodt Chemical Works, St. Louis, Mo.	**STANDARDS** **Speaker:** J. T. HEALD, The Stetson Shoe Company, South Weymouth, Mass. **Subject:** **"Quality Control Standards in Shoe Manufacture"** **Speaker:** GEORGE T. McCOLLOUGH, JR., Wyandotte Chem. Corp., Wyandotte, Mich. **Subject:** **"Quality Control Standards for Laboratory Precision"** **Moderator:** RALPH E. WAREHAM, Consultant, Chappaqua, New York
G	**ARMED SERVICES** **Panel:** E. J. GIBSON, Department of the Army, Washington, D.C. GEORGE L. HEAP, Department of the Navy, Washington, D.C. JOSEPH G. SCHNEIDER, Dept. of the Air Force, Wright-Patterson AFB, Ohio **Subject:** **"What the Department of Defense Expects of Contractors"** **Moderator:** JOHN J. RIORDAN, Department of Defense, Washington, D.C.	**ARMED SERVICES** **Panel:** CARLTON M. BEYER, Department of Defense, Washington, D.C. RICHARD H. DeWITT, Department of Defense, Washington, D.C. CHARLES E. McLAUGHLIN, Department of the Air Force, Dayton, Ohio **Subject:** **"New Developments in Reliability"** **Moderator:** DONALD W. PATTERSON, Department of Defense, Washington, D.C.	**METALS TECHNICAL** **Speaker:** CHARLES J. HUDSON, Consultant, West Boylston, Massachusetts **Subject:** **"The Quality Control Program at Miniature Precision Bearings, Inc."** **Moderator:** SIDNEY S. LEWIS, United States Metals Refining Company, Carteret, N. J. **Speaker:** WARREN E. JONES, Management Controls, Des Plaines, Illinois **Subject:** **"Exploring Electrochemical Processes"** **Moderator:** JOHN F. OCCASIONE, American Steel and Wire Div.—USS, Cleveland, Ohio
H	**MANUFACTURING AND ASSEMBLY** **Speaker:** AUGUST B. MUNDEL, Sonotone Corporation, Elmsford, New York **Subject:** **"The Role of Statistical Quality Control in the Assembly Operation"** **Moderator:** FRANK J. SINDELAR, IBM Corporation, Poughkeepsie, New York	**MANUFACTURING AND ASSEMBLY** **Speaker:** M. P. RACITE, IBM Corporation, Poughkeepsie, New York **Subject:** **"Reliability of Transistor Circuits"** **Moderator:** ROBERT A. LUCAS, IBM Co., Ltd., Toronto, Ontario	**TEXTILE** **Speaker:** OLIVER P. BECKWITH, The William Carter Co., Needham Heights, Mass. **Subject:** **"Quality Control in the Integrated Clothing Plant —From Spinning to Packaging"** **Moderator:** ROBERT G. MITCHELL, International Latex Corp., Dover, Delaware **Speaker:** RICHARD D. WELLS, Fabric Research Labs, Inc., Dedham, Mass. **Subject:** **"Role of Research for Improving Quality"** **Moderator:** DAME S. HAMBY, North Carolina State College, Raleigh, North Carolina

ONVENTION PROGRAM

26, 27, 28

PERIOD IV—TUESDAY P.M. 3:00-4:00

GENERAL INTEREST

Speaker: ENOCH B. FERRELL, Bell Telephone Labs, Inc., Murray Hill, New Jersey
Subject: **"Statistical Methods in Engineering Design"**
Moderator: COURTLANDT C. VAN VECHTEN, Dept. of the Navy, Washington, D.C.

ADMINISTRATIVE APPLICATIONS

Speaker: W. J. HALLADAY, JR., IBM Corporation, Owego, New York
Subject: **"The Application of the 650 Magnetic Drum Data Processing Machine to the Manufacturing Progress Function"**
Moderator: PAUL A. ROBERT, Precision Products Co. of Cincinnati, Norwood, Ohio

ELECTRONICS

Speaker: VINSON M. LOCKWOOD, Hughes Aircraft Company, Tucson, Arizona
Subject: **"Evaluation of Tube Screening Procedures"**
Speaker: EDWARD SAX, Aeronautical Radio, Inc., Washington, D.C.
Subject: **"A Sequential Chi-Square Test of Attributes"**
Moderator: JOHN B. PRINCLE, Bell Telephone Co. of Canada, Montreal, Quebec

APPLIED METHODOLOGY

Speaker: R. B. MURPHY, Bell Telephone Labs, Inc., New York, New York
Subject: **"Stopping Rules for Continuous Inspection"**
Moderator: H. A. FREEMAN, Massachusetts Institute of Technology, Cambridge, Mass.

AUTOMOTIVE

Speaker: FREDERICK H. HOWARD, General Motors Diesel, Ltd., London, Ontario
Subject: **"Quality Control in a Locomotive Plant" (Complex Assemblies Produced in Small Quantities)**
Moderator: I. A. DeCROTE, Ford Motor Company, Dearborn, Michigan

CHEMICAL

Speaker: J. STUART HUNTER, Princeton University, Princeton, New Jersey
Subject: **"Analysis and Design of Experiments for Elucidating Reaction Mechanisms"**
Moderator: CHARLES T. SHEWELL, Humble Oil & Refining Company, Baytown, Texas

ARMED SERVICES

Panel: ROBERT A. BANZHAF, Department of the Army, Joliet, Illinois
BESSE B. DAY, Department of the Navy, Washington, D.C.
RICHARD E. BIEDENBENDER, Department of the Air Force, Wright-Patterson AFB, Ohio
Subject: **"New Department of Defense Sampling Techniques and Their Application"**
Moderator: JOSEPH A. GREENWOOD, Department of the Navy, Washington, D.C.

TEXTILE

Speaker: HUBERT M. HILL, Tennessee Eastman Company, Kingsport, Tennessee
Subject: **"A Designed Experiment to Evaluate Yarn Lubricants"**
Moderator: JOHN H. REYNOLDS, Celanese Corporation of America, Rome, Georgia

PERIOD V—WEDNESDAY A.M. 9:00-10:00, 10:30-11:30

GENERAL INTEREST

Speaker: WARREN R. PURCELL, Raytheon Manufacturing Company, Lowell, Mass.
Subject: **"Who Controls Quality—and How?"**
Moderator: LEONARD A. SEDER, Consultant, Malden, Massachusetts
Speaker: HARRY E. SAGEN, Abbott Laboratories, North Chicago, Illinois
Subject: **"Development of Quality Attitude and Pride of Workmanship"**
Moderator: ELLIS R. OTT, Rutgers University, New Brunswick, New Jersey

ADMINISTRATIVE APPLICATIONS

Speakers: ANDREW SCHULTZ & RICHARD W. CONWAY, Cornell Univ., Ithaca, N. Y.
Subject: **"The Manufacturing Progress Function"**
Moderator: PAUL A. ROBERT, Precision Products Co. of Cincinnati, Norwood, Ohio
Speaker: ROBERT WELLER, Alfred Politz Research, Inc., New York, New York
Subject: **"Consumer Research and Quality Control"**
Moderator: WARREN R. PURCELL, Raytheon Manufacturing Company, Lowell, Mass.

ELECTRONICS

Speakers: D. A. HILL & RICHARD A. MYERS, Hughes Aircraft Co., Culver City, Cal.
Subject: **"Procedures and Tables Based on Acceptable Reliability Levels"**
Moderator: J. R. STEEN, Sylvania Electric Products, Woburn, Massachusetts
Speaker: HAROLD J. GULDE, Minneapolis-Honeywell, Minneapolis, Minnesota
Subject: **"Trial Runs for Quality Control Insurance"**
Speaker: HENRY A. SCHUMER, International Resistance Co., Skyland, N. C.
Subject: **"Quality's Neglected Customer, the Engineering Department"**
Speaker: RICHARD A. CARLSON, Sperry Rand Corporation, St. Paul, Minnesota
Subject: **"A Production Manager Looks at Reliability"**
Moderator: GEORGE ARMOUR, General Electric Company, Syracuse, New York

APPLIED METHODOLOGY

Speaker: F. E. GRUBBS, Ballistic Research Lab, Aberdeen Proving Grounds, Maryland
Subject: **"Precision of Measurement and Product Variability"**
Moderator: A. CLIFFORD COHEN, JR., University of Georgia, Athens, Georgia
Speaker: R. A. BRADLEY, Virginia Polytechnic Institute, Blacksburg, Virginia
Subject: **"Recent Research on Statistical Problems in Subjective Testing"**
Moderator: PAUL C. CLIFFORD, State Teachers College, Montclair, New Jersey

AUTOMOTIVE

Speaker: LEONARD G. JOHNSON, General Motors Corporation, Detroit, Michigan
Subject: **"Optimizing a Life Testing Program"**
Speaker: EDWARD OAKLEY, Delco-Remy Division—GMC, Anderson, Indiana
Subject: **"Machine Capability vs. Product Tolerance"**
Moderator: C. G. BAUER, Chrysler Corporation, Detroit, Michigan

CHEMICAL

Speaker: RONALD D. SMITH, Union Carbide Nuclear Company, Oak Ridge, Tenn.
Subject: **"Problem of Certification That Materials Meet Statistical Specifications"**
Moderator: CHARLES A. BICKING, The Carborundum Company, Niagara Falls, N. Y.
Speaker: RICHARD S. BINGHAM, JR., The Carborundum Co., Niagara Falls, N. Y.
Subject: **"A Guide to the Use of Statistics in the Chemical Industry"**
Moderator: OTTO A. KRAL, Minnesota Mining & Mfg. Co., St. Paul, Minn.

METALS TECHNICAL

Speaker: AXEL U. STERNLOF, American Steel & Wire Div.—USS, Worcester, Mass.
Subject: **"Keep It Simple—It Pays"**
Moderator: HAROLD W. WILLIAMS, JR., Inland Steel Co., Indiana Harbor, Indiana
Speaker: E. W. ARMSTRONG, Simonds Saw & Steel Co., Fitchburg, Massachusetts
Subject: **"The Economics of Quality Control"**
Moderator: GEORGE F. WHITE, JR., Reynolds Metals Company, Richmond, Virginia

TEXTILE

Speaker: PHILIP EWALD, USDA Spinning Labs, Knoxville, Tennessee
Subject: **"Statistical Instrumentation for Testing Cotton Fibers and Yarns"**
Moderator: DAVID C. SCOTT, JR., Scott Testers, Inc., Providence, Rhode Island
Speaker: JAMES B. CURLEY, American Viscose Corporation, Marcus Hook, Pa.
Subject: **"Quality Assurance in the Textile Industry to the Ultimate Consumer"**
Moderator: BYRON GRIFFIN, West Point Manufacturing Co., West Point, Georgia

PERIOD VI—WEDNESDAY P.M. 2:30-3:30

GENERAL INTEREST

Speaker: ROBERT G. MITCHELL, International Latex Corporation, Dover, Delaware
Subject: **"Managing the Quality Control Function"**
Moderator: J. M. JURAN, Consultant, Tuckahoe, New York

ADMINISTRATIVE APPLICATIONS

Speaker: JAMES L. DOLBY, General Electric Company, Schenectady, New York
Subject: **"Non-Linear Programming — The Easy Way"**
Moderator: HOWARD L. JONES, Illinois Bell Telephone Company, Chicago, Illinois

ELECTRONICS

Speaker: LEON L. THOMAS, Dunlap & Associates, Inc., Stamford, Connecticut
Subject: **"Accuracy Control in an Electronic Data Processing System"**
Moderator: H. DEAN VOEGTLEN, RCA Service Company, Rome, New York

APPLIED METHODOLOGY

Speaker: ROGER I. WILKINSON, Bell Telephone Labs, New York, New York
Subject: **"Queueing Theory and Some of Its Industrial Uses"**
Moderator: MAX ASTRACHAN, USAF Institute of Technology, Wright-Patterson Air Force Base, Ohio

AUTOMOTIVE

Speaker: F. A. STEWART, Chrysler Corporation, Detroit, Michigan
Subject: **"An Approach to Quality Control in an Automotive Plant"**
Moderator: I. A. DeCROTE, Ford Motor Company, Dearborn, Michigan

CHEMICAL

Speaker: FRANK W. KROLL, JR., Esso Standard Oil Company, Linden, New Jersey
Subject: **"Effective Quality Control Program for the Industrial Control Laboratory"**
Moderator: HARRY L. WEHRLY, Dow Chemical Company, Midland, Michigan

METALS TECHNICAL

Speaker: RALPH F. HUTH, United States Steel Corporation, Gary, Indiana
Subject: **"The Use of Factorial Chi-Square As a Search Technique"**
Moderator: RICHARD H. EDE, United States Steel Corporation, Chicago, Illinois

GENERAL INTEREST

Speaker: LOUIS O. HEINOLD, Federal Products Corp., Providence, Rhode Island
Subject: **"In-Process Control by Means of Control Gaging"**
Moderator: GEORGE TAMIS, Champion Lamp Works, Lynn, Massachusetts

REGISTRATION FORM

Twelfth Annual Convention, American Society for Quality Control

PLEASE PRINT
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Name Mrs. Mr. Miss _____

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Address _____

City and State _____

Mailing address ONLY if different from above _____

PLEASE INDICATE whether you are a Member of A.S.Q.C.

NO ☐ YES ☐

Section _____

If you are making reservations for more than one person, please provide all requested information for each such person on additional sheets using a separate sheet for each person. Your local A.S.Q.C. Section Secretary has additional copies of this brochure, if you need some.

REGISTER IMMEDIATELY: If, after having registered, you are unable to attend, your registration fee will be refunded provided the Registrar is notified by FRIDAY, MAY 23, 1958.

To assist your committee in planning space assignments, please indicate by placing an X in the appropriate boxes below for those sessions which you plan to attend.

	SERIES							
	A	B	C	D	E	F	G	H
PERIOD I								
PERIOD II								
PERIOD III								
PERIOD IV								
PERIOD V								
PERIOD VI								

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	A.S.Q.C. Members	Non-Members
COMPLETE		
Complete: Includes 3 Luncheons, Banquet, and Transactions	☐ $30.00	☐ $33.00
Same as above but without Banquet	☐ 25.00	☐ 28.00
All 3 Days, Technical Sessions Only: No Meals, but includes Transactions	☐ 15.00	☐ 18.00
SINGLE DAYS		
Technical sessions only (Luncheons and Transactions Extra) Monday	☐ 5.00	☐ 6.00
Tuesday	☐ 5.00	☐ 6.00
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Extra Meals:		
Monday Luncheon	☐ 4.00	☐ 4.00
Tuesday Luncheon	☐ 4.00	☐ 4.00
Wednesday Luncheon	☐ 4.00	☐ 4.00
Annual Banquet, Tuesday	☐ 7.00	☐ 7.00
Extra copies of Transactions, each	☐ 3.00	☐ 3.00
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TEAR OUT

Twelfth Annual Exhibition Displays

Booth A9

KEYSTONE CAMERA CO., INC.

Featured at the Keystone Camera booth will be convention films, slides of quality control in action at the Keystone plant, methods of analyzing field returns, and a large graphic backdrop showing a flow pattern of Keystone's quality control program. New products that will be on display include Keystone's 8mm with lock on light meter K25, 27, 28; the electric eye turret camera; and their new low price K60 projector.

Booth A15

GREIST MANUFACTURING CO.

On exhibit will be the Micro-Height Gage in two models—2 inch and 4 inch. Demonstrations of this tool in relation to quality control problems will be given. Two models of the Griest Micro-Scriber with solid carbide tip will also be shown. A new Height Gage with 18 inch capacity featuring rapid positioning to any reading point and automatic adjustment for wear will be displayed.

Booth A19

THE L. S. STARRETT CO.

The L. S. Starrett Co. at Booth A19 will display their complete line of precision hand measuring tools including dial indicators and dial gages. Also on display will be many new items recently developed including regular and special micrometer heads designed for use particularly in the electronic industry.

New products featured will be #123 Satin Chrome Plated Vernier Caliper with open face vernier in a variety of sizes, #T465 large barrel Micrometer Head, #244 End Measuring Rods, Decimal Graduated Rules, and #657AA Magnetic Base Indicator Holder.

Booth A34

SIMONDS SAW AND STEEL CO.

Designed to provide an attractive display of the wide variety of Simonds products, this exhibit includes representative samples of all types of circular and band saw blades for cutting wood, metal, plastics, etc.; hand and power hack saw blades; files of all types; machine knives of all types; rotary slitter knives; squaring shear blades; flat ground steel; circular cutters; gang saws, and miscellaneous special products.

Also on display will be low carbon flat ground steel, a hard rim circular metal saw, and a chrome plated si-clone circular saw.

Booth B5

GILLETTE SAFETY RAZOR CO.

Gillette's exhibit will depict the company's interesting growth history regarding product development. In addition, photographic displays of their manufacturing process will enable visitors to see just how statistical quality control is infused into all phases of their manufacturing operation. Specimens of early razor blades and some information pertaining to the patent history of the product will also be shown. A large model of Gillette's latest adjustable exposure razor will be displayed.

Booth B6

Wilson Mechanical Instrument Division AMERICAN CHAIN & CABLE CO., INC.

The feature of the exhibit will be the fully automatic "Rockwell" Hardness Tester. This tester is ideal for automotive, aircraft, and bearing work. It uses tiny photo transistors and intricate timing mechanisms. It is able to test both ferrous and non-ferrous metals, in hard or soft condition. It is capable of performing more than twice as many tests for a given period than the average manual tester. Other models of standard hardness testers will be shown.

Booth B9

FRIDEN CALCULATING MACHINE CO., INC.

New methods and systems for faster, more automatic quality control computa-

HOTEL RESERVATIONS

Detach the coupon below and fill in all the required information. Indicate your alternate preferences of hotels and accommodations by placing the numerals 1, 2, and 3 in the appropriate hotel boxes and a check mark (√) in the box indicating the type of accommodations desired. Single rooms are at a premium; therefore, please arrange to double up wherever possible. Mail the completed form to the *Housing Bureau, Boston Convention and Tourist Bureau*, 80 Federal St., Boston 10, Mass.

Should the requested room in the hotels you selected be reserved prior to the receipt of your reservation, the Housing Committee will assign you comparable accommodations elsewhere. The hotel accepting your reservation will confirm directly to you.

IMPORTANT: Reservations mailed to the Convention Bureau must be received not later than May 15th. While the Convention Bureau will try to handle requests after this date, room commitments made by the hotels will have lapsed, and there can be no guarantee that reservations can be made. If, after making reservations, you find it impossible to attend, please notify the Housing Bureau promptly. Confirmed reservations will be held by the hotel only until 6:00 p.m. of the arrival date unless later arrival time is specified.

HOTEL RESERVATION FORM

1958 A.S.Q.C. CONVENTION—BOSTON, MASSACHUSETTS—MAY 25, 26, 27, 28, 1958

Convention Headquarters—Statler and Sheraton Plaza (Check Hotel and Type of Accommodation desired)

CHOICE OF HOTELS	Single Room Daily Rates ☐	Double Room Daily Rates ☐	Twin Bedroom Daily Rates ☐	Suites (2 Room) Daily Rates ☐
☐ BELLEVUE HOTEL ..... 21 Beacon Street	$6.75 to $ 9.75	$10.00 to $13.00	$12.00 to $19.00	$26.00
☐ BRADFORD HOTEL ..... 275 Tremont Street	7.00 to 9.50	10.00 to 12.50	12.00 to 14.50	17.00 to $22.00
☐ LENOX HOTEL ..... 61 Exeter Street	5.25 to 9.25	8.25 to 12.50	8.25 to 13.50	10.00 to 18.00
☐ SHERATON PLAZA HOTEL ..... 138 St. James Ave.	8.50 to 15.00	12.00 to 19.00	15.00 to 19.00	30.00 to 40.00
☐ STATLER HOTEL ..... Park Square	8.00 to 13.50	13.00 to 17.00	14.50 to 18.00	33.00 to 37.50
☐ TOURAINE HOTEL ..... 62 Boylston Street	7.50 to 10.00	10.50 to 12.50	10.50 to 14.00	19.00 to 20.00

ROOM RATES SUBJECT TO CHANGE WITHOUT NOTICE

ARRIVAL DATE ..... **Time** ..... **DEPARTURE DATE** .....

IMPORTANT: Mail Hotel Reservation Forms to:
HOUSING BUREAU, Boston Convention & Tourist Bureau, 80 Federal St., Boston 10, Mass.

Reservations for: (Please print Name—Address)

(1) .....

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Additional Occupants (Name and City)

(2) .....

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Statistical Courses

The statistics section of the Virginia Academy of Science and the Virginia Academy of Science Chapter of the American Statistical Association cordially invites members of ASQC to attend meetings of the section of statistics at the Hotel Roanoke, Roanoke, Virginia, on May 9-10. The program for this meeting is as follows. Please note that three sessions are devoted to industrial applications of statistics.

Friday, May 9

Combined Inter- and Intra-Block Analysis for Factorials in Incomplete Block Designs, R. E. Walpole, Roanoke College

The Use of Response Surface Analysis on Biological Material, D. C. Hurst, Virginia Polytechnic Institute

Triangle, Duo-Trio, and Difference from Control Tests in Taste Testing, R. A. Bradley, Virginia Polytechnic Institute

(Industrial Statistics I)

Introduction to Statistical Sampling Inspection, G. F. White, Jr., Reynolds Metal Co.

Application of Variance-Length Curves in Product Quality Analysis, William D. Hicks, Fieldcrest Mills, Leaksville, N. C.

Methodology for the Improvement and Analysis of Unsatisfactory Condition Data on a Complex Automatic Electro-Mechanical System, James R. Duffet, Virginia Polytechnic Institute

(Industrial Statistics II)

Analysis and Reduction of Variations in the Processing Plant, N. L. Enrick, Institute of Textile Technology

Application of Linear Programming to Dope Metering Pump Replacement, J. W. Cowdery, Celanese Corporation of America

(Industrial Statistics III)

Errors Associated with Process Adjustments, J. Edward Jackson, Virginia Polytechnic Institute, and R. A. Freund and W. G. Howe, Eastman Kodak Co.

A Designed Experiment to Evaluate Seven Year Lubricants, H. M. Hill, Tennessee Eastman Co.

Saturday, May 10

Analysis of Variance of a Randomized Block Design with Missing Observations, W. A. Glenn and C. Y. Kramer, Virginia Polytechnic Institute

Analysis of Variance of a Latin Square Design with Missing Observations, Susan Glass, Roanoke College and C. Y. Kramer, Virginia Polytechnic Institute

Significance Tests in Paired Comparisons, T. H. Starks and H. A. David, Virginia Polytechnic Institute

Generalized Distributions and the Problem of Confidence Statements in Multivariate Analysis, Rolf Bargmann, Virginia Polytechnic Institute

Some Probability Theory of Tests of Varied Components, C. W. Clunies-Ross, Virginia Polytechnic Institute

Additional information may be obtained by writing to:

Ralph A. Bradley
Professor of Statistics
Virginia Polytechnic Institute
Blacksburg, Virginia

tions and reports will highlight demonstrations of such remarkable Friden products as the fully automatic square root calculator, Model SRW (the only desk calculator made that is capable of automatic extraction of square root); the FLEXOWRITER, automatic writing-accounting machine; the ADD-PUNCH, automatic code tape adding-listing machine; and the Friden Natural Way Adding Machine.

A new product to be featured will be their Model APT-10, ADD-PUNCH, with new features for greater speed and built-in reliability. It automatically produces a common language punched tape by-product of normal adding or listing.

Booth B10

MILES REPRODUCER CO., INC.

Now, with the improved "WALKIE-RECORDALL", the amazing miniature Conference Recorder-Transcriber, "on-the-spot recordings may be made in or out of closed briefcase. Self-powered; no wires; no warm-up period; no exposed microphone. Completely noiseless operation.

Picks up and records voice within a 60-foot radius screening interferences such as typing, coughing, air-conditioners, traffic, etc. Designed especially for recording conferences, lectures, interviews, sales training, reports, investigation, dictation, 2-way telephone, etc.

To adapt this Conference Recorder for dictating in noisy places, an optional built-in provision permits the exclusion of everything except the voice spoken or whispered close to the mike—indoors or outdoors, in the office, field, car, train, plane—without any interference from noises such as near-by conversations, motors, engines etc.

Operates from self-contained standard dry batteries costing only 1c per hour. Recording is continuous up to 4 hours on each side of a non-flammable safety-film belt costing only 3c per hour. Recordings are permanent, non-magnetic and non-erasable, unaltered and indexed. Easy to file or mail.

Be sure to see the "WALKIE-RECORDALL" at Booth B10!

Booth B12

AMERICAN CYSTOSCOPE MAKERS, INC.

American Cystoscope Makers, Inc., extend a cordial invitation to members and guests to vist Booth B12. Latest type and design borescopes, optical flats, and miniaturized lamps will be on display. Representatives will welcome the opportunity of discussing any applications you may have for these items.

Booth B14

B. C. AMES CO.

Micrometer dial indicators, micrometer dial gauges, and dial micrometers will be on display. The exhibit's special emphasis will be on new long range indicators and angularity gauges.

Booth B18

FEDERAL PRODUCTS CORP.

New products and applications abound in Booth B18. These include: Federal's new Transistorized, electronic test indicator—the Electro-Probe; in process machine control; hole location gaging; new long range, high magnification testmaster; new cross hole gaging techniques; several types of new dial indicating gages; new high magnification dimensionair; and a new modular air-electric switch unit.

Booth B26

CARL ZEISS, INC.

Products on display at the Carl Zeiss, Inc. booth include an interference microscope for super finish surface analysis, a metallurgical microscope, the Epi microscope, a technoscope, and the stero microscope.

Other products include the universal measuring microscope, large and small toolmaker microscopes, light section microscopes, and measuring microscopes.

Booth B27

VAN KEUREN CO.

The Van Keuren Co. will display a complete line of precision measuring tools and gages. These will include light wave micrometers, optical flats, monochromatic lights, thread and gear measuring wires, gage blocks, and plain plug gages in steel, chromeplate, and carbide.

A new reflex viewer in conjunction with micro-koted optical flats and a new line of DUPLEX plug gages will be shown in Boston for the first time.

Booth B31

ELLIOTT SERVICE CO., INC.

Highlighting the Elliott Service Co. booth will be employee motivation programs aimed at treating the general topics of quality, reliability and waste as in-plant advertising for employee assimilation; selling work improvement programs visually to employees; management information for foremen and supervisors; and suggestion plan materials and equipment.

The New Hi-Vision treatment of quality and reliability subjects include newly developed three-dimensional display frames.

Booth B33

National Electric Instrument Division ENGELHARD INDUSTRIES, INC.

Internal inspection devices of all types, featuring "FONTAR"® borescopes in diameters of 0.095 inches and over will be on display at Booth B33. In addition, new industrial internal illuminators, both rigid and flexible types, in a wide range of diameters and lengths and some with mirror attachments, and instruments in standard length with wide variety of custom sizes will also be available.

Booth B35

MAGNAFLUX CORP.

This display of non-destructive testing systems will include the Magnatest FS-300 electronic instrument used for evaluating and sorting magnetic materials according to alloy composition, heat treat condition, depth of case, and carbon content; the Sonizon ultrasonic unit for measuring thickness of metals and other solids from one side only; and the Zyglo ZA-43 Kit—fluorescent penetrant inspection for locating cracks and nonmagnetic materials.

Booth G9

M. E. CUNNINGHAM CO.

The products that will be exhibited at the M. E. Cunningham Co. booth are as follows: Mecco Safety Steel Inspection Stamps, Sharp Face Style, Standard Round Face Stress-Less Style and Special 0.003 Deep Round Face No-Stress Stamps. The latter are used for critical stress sections of aircraft and other material; Inspection Hammers—Insert and Solid Style; Mecco Safety Letters and Figures—Hevi-Bevl and Wedge Grip Style; Utility Marking Outfit; Wedge Grip Hand Model Holders and Type; Style OE Safety Engineer Hammers; GRD-960-2 Marking Fixture; SF-100 Stamping Fixture.

What's New ?

(Continued from page 18)

difficult and delicate jobs this COLLIMATOR will do. Simplicity in operation and absence of moving parts, which are always possible sources of errors, make it ideal for shop use, especially since shocks or mishandling of the instrument cannot diminish its accuracy. The OPTO-TOOLING - AUTO - COLLIMATOR is offered in a "B" unit having a working range of up to 15 feet from the auto-collimator. The "D" units have an unlimited distance range. Various models have a total field of 30 minutes of angle directly reading to 15 seconds of arc, 10 minutes of angle directly reading to 5 seconds of arc and 9 minutes along one axis only directly reading to 1 second of arc. A four page folder, illustrating and explaining the many practical uses, with detailed specifications, prices etc. may be obtained from the George Scherr Co.

★ ★ ★

Jackson Electronic and Mfg. Co., 695 Johnson St., Akron 6, Ohio, has developed a unit which provides programmed automatic control for most types of high potential insulation testers now in use. The function of the Jackson Program Unit Model 1102 is to program the line voltage fed to the high-pot tester, thus producing a system in which test voltages are automatically applied to components under test at a uniform, controlled rate. Designed for laboratory or production line testing, the programmer reduces the element of human error in the test procedure, prevents equipment damage due to accidental output surges, and assures that each component is given an identical, precisely controlled test. The unit plugs into the line between the voltage source and the high-pot tester. In one complete cycle the programmer (1) starts at zero volts output and rises at a uniform rate to full voltage output in 6.5 seconds, (2), dwells at full voltage for a preselected time period of from 1 to 60 seconds, and (3) returns to zero voltage at a uniform rate in 6 seconds. A memory circuit prevents application of an output surge should the line voltage be interrupted during cycle. In this event, output voltage remains at zero and the unit cycles to "home" before voltage can be again applied. The unit operates on a 115V, 60-cycle line. Output current is 3.5 amps. It is fully portable and is housed in a rugged, rack-style steel cabinet with lid and carrying handle. Overall dimensions are 9⅜ × 15 by 9 inches. Weight, 24 lbs. Rack mounted model also available, panel height 8¾ inches.

★ ★ ★

A Phase Angle Meter and Monitor which provides direct reading, together with high accuracy over a wide frequency and amplitude range, has been developed by **Control Electronics Co., Inc.,** Huntington Station, N. Y. The equipment, designed originally for the Air Force Rome Air Development Center, provides accurate and rapid measurement of phase difference, no matching of amplitudes or wave forms being required. It offers direct reading 0 to 360 degrees with accuracy ±1 degree, 20 to 20,000 cps, and makes possible continuous, unattended monitoring of phase angle by use of chart recorder. The Model 120, Phase Angle Meter and Monitor is made for use in the testing and inspection of servo amplifiers, feedback amplifiers, audio and power transformers, resolvers, goniometers, synchros, and polyphase systems. It accepts sinusoidal or complex wave forms and an output is available which is suitable for use with recording equipment. Weight is 59 lbs. and dimensions are 11½ × 20 × 18 inches. The unit can be mounted in a standard 19 inch rack when the cover is removed.

★ ★ ★

William J. Hacker & Co., Inc., 82 Beaver Street, New York 5, N. Y. announces a Torsional Damping Tester "Z-466" designed for investigating torsional elasticity and damping effects in plastics, rubber, artificial leather and similar materials by means of free oscillations. The device can be arranged to clamp foil specimens, tubular specimens and round solid specimens. Temperatures ranging from −50 degrees to +300

degrees C. can be obtained in the testing chamber by means of connecting the instrument with refrigerators or heaters as needed. Three thermo couples provide a constant check-up of the temperature. A protective gas can be introduced into the testing chamber for specimens corroding when exposed to air. For the test, the specimen is inserted with its upper end in a fixed clamp which can be turned from outside for initiating the oscillations; on the lower specimen end an inertia disc with a little mirror is attached. The oscillations which are fading according to the damping qualities of the specimen are recorded by a photographic apparatus. The frequencies are about 0.1 to 20 per second; and are variable according to the selected inertia disc.

★ ★ ★

The Model 1100 Magnetic Core Tester has been announced by **Rese Engineering, Inc.**, 731 Arch Street, Philadelphia 6, Pa. Of modular construction, for expanding test requirements, the Model 1100 is notable for its precisely controlled, fully programmed, high amplitude current pulses; for laboratory analysis and production testing of a wide range of magnetic materials. The unit incorporates a program generator, stabilized power supplies and three current drivers operating from ground level. Two of the drivers deliver negative pulses up to 2 amperes and the positive driver delivers pulses to 3 amperes, providing maximum utility in single turn testing of magnetic cores. With a high source impedance, the current drivers have a dynamic range in excess of 250 volts, for testing and analysis of large tape wound cores and other highly reactive loads. Rise time is very fast . . . to less than 0.10 microseconds, with pulse widths as short as 0.50 microseconds. Both linear and exponential rise times are fully controlled, and continuously variable to 2 microseconds to 1 microsecond. The program generator develops a basic, 8 step, periodically repeated pattern with a maximum step repetition frequency of 50 K.C. The program may be automatically stopped at any one or more non-adjacent steps and made to repeat the scheduled pulse up to 5000 times. In addition, any two non-adjacent step-pairs may be repeated up to 2500 times. The repeat feature is particularly valuable for the study of circuit PRF sensitivity, duty-factor effects, core demagnetization, minor hysteresis loop analysis and other applications requiring unusual pulse programming. Modular construction of the Model 1100 provides maximum flexibility through the addition of units for more complex programming or the addition of Model 1080 Precision Voltage-Current Calibrator.

★ ★ ★

Production of the Glennite Laminagage, Model FLW-1 designed for the precise and nondestructive measurement of the thickness of coatings and platings on base materials, is announced by **Gulton Industries, Inc.**, 212 Durham Ave., Metuchen, N. J. It can be used for the thickness measurements of metallic film or foil and will detect surface and sub-surface cracks in smooth and rough coatings, flat stock or plate and tubing. In addition it can be used to measure coating thicknesses of odd shaped pieces and on assembly lines where the thickness of coatings must be continuously monitored. The Laminagage is also designed for use in automated, process control applications, for which Gulton Industries, Inc. will provide the necessary engineering services. The unit operates on the swept frequency eddy-current principle and will measure coating thicknesses over the range of 0.00005 to 0.007 inches with an accuracy of 10 percent. With the instrument featuring extremely high resolution and stability, ferrous and nonferrous materials and a wide range of conducting and non-conducting coatings on conducting base materials can also be measured. As conductivity and permeability differ, each application demands its own frequency bandwidth, calibration and probe. Oscillator units, probes and calibration charts supplied with the instruments, are interchangeable and may quickly and easily be replaced. Applications of the Laminagage include: crack detection in basic metals such

PROCEEDINGS OF THE RUTGERS ALL-DAY QC CONFERENCE

The 14 papers presented at the Eighth Annual Rutgers Conference held in September have been prepared in a bound volume and are now available. A wealth of information is yours by obtaining these papers.

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Application of Statistics in Pharmaceutical Manufacture
A Case History of the Installation of a Quality Control Program in a Refractories Plant
Statistical Quality Control as a Management Philosophy
Work Sampling
Quality Control from the Ground Up
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CASE HISTORIES ON STATISTICAL METHODS FOR QUALITY CONTROL

A case history approach to examples of applications of known statistical methods has been prepared by the Metals Technical Committee and is now available.

A survey of the use of statstical methods in the metals industries resulted in selection of the general field of correlation. The resulting set of methods published covers a wide range of problems and degrees of difficulty or sophistication.

The publication is not intended for the professional statistician, but rather the men in the field who encounter problems of variation and must deal with these problems either by intuition, by haphazard methods, or by whatever efficient methods they are able to discover and master.

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as cast iron, brass and carbon steel, determining uniform thickness of paints and porcelain enamel coatings; thickness of tin plate, anodized aluminum or tinned surface as well as copper, brass, etc., and determination of overlay thickness. The Laminagage is produced under patent rights held by General Motors Corp.

★ ★ ★

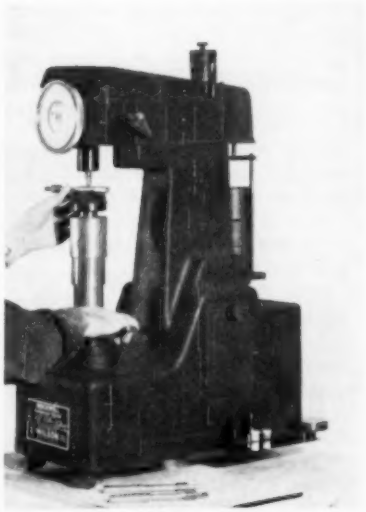
Daco Instruments Co., Tillary and Prince Streets, Brooklyn 1, N. Y. announce the Daco Gear Train Analyzer, a testing instrument to quickly and accurately evaluate lost motion in precision gear trains such as those produced for use in servo units, computers, guided missiles, etc. The Analyzer is particularly adaptable to high ratio gear trains having small in-put torques, and is applied complete with instructions and a manual on gear train design and analysis. The Analyzer consists of an electronic control console and a two-

phase torque actuator. The torque actuator is substituted for the motor drive of the gear train to be checked. A dial on the control unit regulates voltage to the actuator, and a read-out dial on the actuator enables the inspector to precisely determine angular displacement of the actuator shaft during the test. Thus total lost motion is measured by applying constant torque to the input pinion of the locked gear train and reading clockwise and counter-clockwise actuator shaft displacement. In addition to its standard function as a production inspection instrument, the Daco Analyzer measures torque required to drive free running gear boxes, facilitates adjustment of gear meshes and bearing alignments during assembly, and provides a means of setting gear train safety clutches. It also provides a practical method for testing gear trains under various environmental conditions. The unit operates on 115 volt, 60 cycle supply, the control unit is 21½ inches wide, 14¾ inches deep, 11½ inches high and weight is approx. 52 lbs.

★ ★ ★

An addition to the line of Wilder Micro-Projectors is announced by **Opto-Metric Tools, Inc.,** 137 Varick Street, New York 31, N. Y. The new floor model, A-F, is a fully self-contained and self-supporting unit of modern, compact design and will be found particularly useful alongside of machine tools or wherever space is at a premium. The screen is at a convenient table height and is inclined. Toe space is provided under the cabinet, which is finished in a grey hammertone material for repelling dust and dirt. The floor model is available in six selective magnifications and with a choice of three different measuring stages, centers, surface illumination, protractor as well as measuring screens.

★ ★ ★



The Wilson Mechanical Instrument Division, **American Chain and Cable Company, Inc.,** Bridgeport 2, Conn. has announced the Rockwell Hardness TwinTester. This combination tester was primarily designed for conducting Rockwell and Rockwell superficial hardness testing applications of materials in tool departments, maintenance repair shops, laboratories, inspection departments, small-lot metal jobber shops, etc., requiring only limited use of hand-operated Rockwell testers. The TwinTester, a combination Rockwell and Rockwell superficial hardness testing instrument, is capable of performing the work of two conventional single-range units in measuring the Rockwell hardness of metals and alloys of all types whether hard or soft, polished or unpolished, round, flat, tubular or irregular in shape. The instrument features a large direct-reading dial gage with one zero-set position which is marked four scales: "B" and "C" to indicate Rockwell hardness and "N" and "T" to indicate Rockwell superficial hardness readings. The operator can change from Rockwell to Rockwell superficial hardness testing procedures in a few seconds through the addition or subtraction of major load weights that are suspended from a hanger at the rear of the unit and raising or lowering the minor load weight at the top of the instrument. Major load weights of 15, 30, or 45 kg. are applied together with the minor load weight of 3 kg. for Rockwell superficial testing of materials. For Rockwell hardness testing, major load weights of 60, 100 or 150 kg. are applied together with the minor load weight of 10 kg. All weights, including minor and major, are clearly marked and always visible to insure proper load application and are so constructed that they can only be stacked in proper progression. The TwinTester is furnished with cowl, $\frac{1}{16}$ inch steel ball penetrator for B and T scale testing, two each of B,C,N, and T scale Rockwell test blocks, plane, spot, shallow V and Cylindron Jr. Anvils, dust cover, protective sleeve set and sub-sleeve. Available as optional equipment are diamond Brale penetrators for C scale testing, and N Brale for N scale testing and a combination Brale penetrator for N and C scale testing. Assorted test blocks are also available for testing the instrument's accuracy. The unit's vertical capacity is 8, 12 or 16 inches and its throat depth is 5½ inches. Bench space required is approximately 12 by 20 inches.

New Literature Available

A 20 page manual type brochure describing air gage members for all types of circuits was published re-

cently by the Freeland Gauge Co., 9940 Freeland Avenue, Detroit 27, Michigan. This manual, entitled "General Reference and Order Guide—Air Gage Members for All Circuits," attempts to orient the reader in the general principles of basic air gage instrument design and engineering. Air gaging as a dimension measuring science is treated broadly in the introductory section of the manual. Following this introductory section are three additional sections which treat the three major types of air gage circuits—back pressure, flow type, and the differential types.

A new bulletin describing the full line of Slocomb micrometers, including many labor-saving special types, has just been published by the J. T. Slocomb Co., Glastonbury, Conn. It includes complete information on Slocomb standard micrometers, data on large micrometers regarding maximum sizes, measuring range in the various sizes, and an informative section on the unconventional micrometers Slocomb makes.

A new edition of the Gurley Bulletin on Testing Instruments, featuring instruments with complete automatic timing, has been published by W. & L. E. Gurley, Troy, N. Y. Among the instruments included are: The Gurley Stiffness Tester, which measures the flexibility of sheet materials (such as paper, cloth, felt, thin metal and plastics); The Gurley-Hill S-P-S Tester (Smoothness-Porosity-Softness), developed to test the printing quality of papers; the Gurley H-P-S Tester (High Pressure Porosity and Smoothness Tester) for single-side smoothness tests of paper, paperboard and paper products, as well as paper where it is desired to test the smoothness of the felt and wire sides separately. Other instruments are the Gurley R.D. Smoothness Tester, various models of Gurley Densometers for measuring porosity, air-permeability, or air resistance of paper and paper products; Gurley-Cobb Sizing Tester for testing sizing of paper and paperboards in terms of resistance to absorption of water and oil; Gurley Permeometers for measuring porosity of materials too porous to be tested with Densometers; glass calibration plates, safety guards and instrument bases.

The second in a series of Technical Information Bulletins regarding the use of Nitrous Oxide for leak detection systems has just been released by Ohio Chemical and Surgical Equipment Co. (A Division of Air Reduction Co., Inc.), 1400 East Washington Avenue, Madison, Wis.

The Johnson Gage Co., 534 Cottage Grove Road, Bloomfield, Conn. has made available Bulletin No. 400 entitled "Does the Three-Wire System Measure True Pitch Diameter" and Bulletin No. 401, "The Effectiveness of Various Contacting Elements Used for Gaging and Measuring Pitch Diameter." These bulletins discuss subjects which are most timely, particularly in light of new specifications and gage requirements outlined in the 1958 Revision of the Handbook H-28, Screw-Thread Standards for Federal Services.

From the Scrap Box

MASON E. WESCOTT, *Editor*

University College, Rutgers University, New Brunswick, N. J.

Quality Control and the Consumer

Some whys and wherefores concerning a conference sponsored by Rutgers University, Consumers Union, and the American Society for Quality Control

THE *Wall Street Journal* carried a front-page story a few weeks ago about a whole rash of breakdowns in some components supplied by General Electric for fluorescent lights. The components had turned out defective in use; GE's factory inspection had slipped somewhere along the line.

A moderately close reading of the business and trade press will turn up stories of the same sort in almost any given week. The fact is that slips in quality control of a wide range of commodities have been showing badly.

Here is a random sampling of items from recent issues of several trade publications:

"The furniture manufacturers . . . have literally gotten away with murder. . . . Poor inspection is an epidemic almost nationwide. Have manufacturers no conscience any more?" (Letter from a dealer, published in *Home Furnishings Daily.)*

"If our industry and the fabric industry do not give heed to the quality problem, the public is going to be convinced that modern upholstered furniture is inferior to that of 25 years ago." (An officer of the National Association of Furniture Manufacturers.)

A "major problem confronting electrical housewares buyers and independent dealers is the increasing return of some types of electrics. . . . Toasters, steam and dry irons and percolators [are causing] the most trouble. . . ." *(Retailing Daily).*

Other stories have noted dealers' problems with defective tape recorders, refrigerators, floor tiles, and many other products. Meanwhile, more technical stories in more specialized journals have given steady attention to the complexities of quality control methods.

However much poor quality control may bother manufacturers and dealers, it affects the consumer much more. Not only can it cost him money; it can cost him his life. In many test projects involving electri-

Editorial Note

The material published herewith comes to IQC by permission from the October 1957 issue of *Consumer Reports*. It deals with an aspect of quality control which is beginning to be explored in a serious way in a number of directions. The first official conference, reported briefly in this article, focused attention on some of the aspects and possibilities of more effective quality control in the interests of the consumer and stimulated what may well prove to be some constructive effort to get the concepts and practices of modern quality control more actively into the consumer field.

M. E. W.

cal appliances, CU has found products that present a severe shock hazard arising from carelessness in manufacture (see "Shock News and Shock Hazards," *Consumer Reports*, September 1957). The danger of such products was made dramatically plain recently when a Chicago boy was electrocuted by a 1958-model TV set which the coroner's jury found defective (a wire had been "pinched" during assembly).

The average home today is equipped with a multitude of products that can be hazardous if the manufacturer has been careless. For example, the Canadian government not long ago charged that faulty lamps made in the United States had caused fires costing millions of dollars in Canada. Even furniture, when it is defective, can be dangerous, as witness this report in *Retailing Daily*: "Juvenile furniture dealers all over New York have suddenly found themselves up to their necks in accident suits in which faulty merchandise has been involved."

From its years of experience in testing many kinds of consumer products, CU has become more and more concerned with the consumer's large stake in the establishment and maintenance of good quality control by manufacturers. This concern prompted CU to join a small group which assembled last March (from the American Standards Association, the American Society for Quality Control, the American Society for Testing Materials, the Bell Telephone Laboratories, Massachusetts Institute of Technology, and several industrial organizations) under the sponsorship of Rutgers University to discuss quality control from the point of view of both the consumer and industry. Out of this pilot conference grew plans for a second and larger conference on "Quality Control and the Consumer" under the co-sponsorship of Rutgers, Consumers Union, and the American Society for Quality Control (Vendor-Vendee Committee and Textile Division).

The second conference, which was held for two days last month on the Rutgers campus at New Brunswick, N. J., heard speakers on a variety of topics related to the general question of how quality controls might be improved and extended.

While many of the discussions dealt with technical aspects of quality control methods, others were directed to broader consumer interests. From several of the latter, CU has culled the following excerpts:

Needed: better communication

Quality-control experts speak of three basic processes in the control of quality: specification, production and inspection. Step by step, these processes call for the development of new communication channels between producers and consumers.

(1) *Specification* of desired qualities and tolerable degrees of variation in consumer goods can never be better than the ability of consumers to analyze their needs and wants, or the ability of producers and designers to find out what these needs and wants are. A great deal of market research is currently and often ineffectively aimed at this problem. The researchers commonly attack the consumer's mind . . . to see how he can be persuaded to buy a product the client wants to sell instead of inquiring what kind of product the client should design.

(2) *Production* in the narrower sense—manufacture and processing—is largely beyond the scope of consumer control, and is pretty closely and rationally managed by the enterprises involved. But . . . it appears that a good deal of waste effort goes into competitive duplication, haphazard and uncontrolled inventory fluctuations, and sales methods not well adapted to the needs of the intelligent and informed shopper.

(3) *Inspection* is ultimately the problem of consumers who, in the normal course of events, subject the entire output of industry to a continuous process of destructive use-testing. In current practice the results of these tests are largely lost . . . fre-

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quency-of-repair data which Consumers Union collects from automobile owners in its annual questionnaire is an indication of a possible development of this sort. But with few exceptions, very little general information exists about what happens to products once they are taken home and put to use.

WILLIAM HALLER, JR., Dickinson College

Preference vs. utility

"What does the consumer want?" is a more fundamental question than "Does the consumer experience utility from what he buys?" Even if utility is generalized to mean any form of satisfaction, it remains only one of the determinants of consumer acceptance along with impulse, habit and social pressure. In considering response to new products whose usefulness or enjoyment the consumer merely anticipates, the concept of preference is a more useful analytical tool. . . .

Typical of a . . . tangible problem of quality control is to determine what mixture of qualities in telephone service the consumer would rather have. If rates are fixed, how shall revenue from these be apportioned to improve hearing fidelity, reduce waiting time or calls, lighten the weight or size of the telephone instrument, or increase reliability of service? Or, to consider a larger question, what quality level of telephone service in general would the consumer prefer to pay for through increased rates in relation to the amounts he spends on other necessities, conveniences or luxuries . . . ? In every consumer product, the question also arises of how much quality the consumer is willing to pay for. Would he rather have a product immune from failure at a high price or one with some need for service at a lower price?

BURNELL H. BENSON, Drew University

A possible answer

As far as the individual consumer is concerned, quality control is still a nebulous something that he reads about in the newspapers and magazines. . . .

Is it possible to formulate some plan for consumer-vendor understanding so that a consumer could intelligently select a specific product, from among a variety on the market, that is most likely to be of proper quality and reliability? I think there is reason for answering this in the affirmative. . . .

As I see it, the architecture of this arrangement is quite simple:

1. The proper agency would define the essential elements of a quality control system. This is the "design for quality control."
2. Producers who wish to advertise their products as "quality controlled" would agree to conform to the design for quality control established by the standards agency.
3. The essential elements of the "design for quality control" would be incorporated into a document which, in turn, would be available to consumers as well as producers and would, of course, be properly publicized.
4. The standards agency would have authority to verify the producer's good faith, i.e., his conformance to the "design for quality control." This verification carries with it, of course, the right of disapproval.
5. The producer would have the right to advertise and stamp his product with the agency's quality control insignia.

What would be the advantage of such a plan to consumers and vendors? Obviously, the consumer would benefit because he would have meaningful information about a product which is advertised as "quality controlled" under the aegis of a recognized agency. The term "quality controlled" would not simply be advertising copy. It would be backed up by a specification defining the nature of the controls and by an agency capable of reviewing the operation of these controls.

But what about the producer? What would he gain? Offhand, I can see two advantages to the producer. First, a marketing advantage over competitors who either do not subscribe or who are not eligible for subscription to the plan. Second, production cost reductions. . . .

JOHN J. RIORDAN, Office of Assistant Secretary of Defense (Supply & Logistics)

A whole new approach

The general installation by industry of quality control systems would provide the Food and Drug Administration with the possibilty of a whole new approach to the problem of consumer protection. The information that industry could provide us, by its quality control systems, would be of inestimable value in our enforcement operations.

WILLIAM WEISS, Bureau of Program Planning and Appraisal, Food and Drug Administration, U. S. Department of Health, Education, and Welfare

The consciousness of consumers

The whole consumer testing movement emerged as a phase of the rising consciousness of consumers of the need for accurate product information. Before such an effort could gain momentum, it was of course essential that some substantial measure of quality control gain wide acceptance. A trade name had to acquire some content in terms of a designated quality before test results could become meaningful. . . .

Quality control requirements have become more exacting in response to the demands of the more critical consumers. Yet while the modern corporation has not been disinterested in intelligent consumption and has rendered substantial assistance, it has at the same time tended in many of its marketing aspects to accent and assist unintelligent consumption. An extended documentation of this point is unnecessary. Suffice it to say that the cigarette companies, the drug houses, and even the automobile companies do not present good examples in consumer education in their public proclamations and sales practices. Corporate practice has all too frequently been to falsify science, to oversimplify it, or to introduce irrelevancies or ambiguous claims which are scarcely tolerable to an intelligent consumer. . . . Advertising has become too largely an exercise in semantic evasion. . . .

In my judgment, the pressures of education working both on the consumer and on business will in time serve to render obsolete many of the appeals now accepted as commonplace in a world so sharply divided between the scientific and the nonscientific. As the spending of money becomes less backward, consumers will increasingly insist upon and obtain well-defined quality standards and emphasis of performance characteristics.

COLSTON E. WARNE, President, Consumers Union

OUR EVER-GROWING FAMILY

With the addition of Lexington (Ky.) the number of sections in the Society is now 102. The Society is proud to extend a most cordial welcome to the new section.

102—Lexington (Dist. 15)

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Lexington, Ky.
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Lexington, Ky.
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Berea, Ky.

Toledo Technical Council Names Julian H. Toulouse Engineer of the Year

Dr. Julian H. Toulouse, Chief Engineer of the Quality and Specification Department of the Owens-Illinois Glass Company, formerly a vice-president of ASQC and currently directing the administrative details of its annual Saddoris Award for Section Management project, was honored on February 20th by the Toledo Technical Council by being named as its "Engineer of the Year." This group represents about 7000 engineers within a 50 miles radius of Toledo, and the recognition it bestowed on Dr. Toulouse is a real distinction since he is only the 4th one to be thus honored. Former awardees include a Dean of Engineering, a Vice President of Toledo Edison, and a Director of Research.

The basis of the award to Dr. Toulouse was primarily his work in the promotion of vocational guidance in the Toledo area. We hear a great deal these days about the imperative necessity in our time for more effective emphasis on technical training in our educational system. Dr. Toulouse has been instrumental in getting the Toledo area to take this important matter out of the talking stage and give it concrete, constructive attention. He has helped the TTC formulate four basic policies, the fourth of which provides a specific 9-point program for active liaison between TTC and the high schools in the area in direct counseling of students by practicing engineers. A major portion of this program is already in operation, and the remainder of it will soon be in active operation.

It is of interest to note the structure of this program.

Ray E. Crouse, (right) president of the Toledo Technical Council, presents the "Engineer of the Year" award to Dr. Julian H. Toulouse.

Policy I—Contacts With Schools

That all contacts with schools by engineering groups be through one source—the engineering consultant or moderator assigned to each school through the TTC Educational Committee. In the City of Toledo, it has already been set up that the engineering consultant be the key engineering representative from the societies to the school and that he will have full jurisdiction over the program with that particular school, calling in as assistants such other engineers as may be helpful for any occasion.

Policy II—Objectives

That the function of the high school vocational guidance program be one of explaining Engineering and assisting in proper pre-college preparation. We will not try to "sell" Engineering in such a way as to induce students to choose our profession against their best interests or ability. We will try to help those worthy students who would like Engineering and who have already expressed an interest in Science or Engineering and particularly we will help those who have felt that they would not be able to go to college for financial or other closely allied reasons, even though they are interested in Engineering.

Policy III—Engineering as an Overall Profession

In our general dealings with schools and students we will present Engineering as a profession and be equally interested in explaining all branches of Engineering without favor. However, when a student or students ask about a particular branch of Engineering we will bring together the student or students and a practicing member of that branch. We will be equally concerned with presenting the facts about the Scientific professions, for Engineering is particularly close to all the Sciences, being generally the interpreter and the practical proponent of the Science.

Policy IV—The Following Program Will Be Activated in Every Way Possible

1. An engineering consultant will be assigned to each school and with him we will work out a staff of engi-

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neering representing different phases or branches of Engineering upon whom he can call for specific help as necessary. This engineering consultant will be permanently assigned to the school and through him all contacts from all engineering groups will be channeled. The object is to avoid any criticism that too many groups are contacting the schools on the same subject.

2. The high school visitation program will generally be divided into two or more groupings. In the case of meetings with advanced students in Mathematics or the Sciences, it will be later in their high school where their choice has been largely made. The talk will, therefore, be built around the mechanism of entering college, particularly drawing attention to the Juniors that they should make their choice of college during the Summer and early Fall and apply no later than early Fall to the school of their choice. They should also be told about the mechanism of applying for scholarships through their high school counselor or principal. They should be told what to expect in college life and particularly should be urged to review the status of their studies so that if any prerequisites remain unfulfilled, they can schedule these during their Senior year or during the two Summer school periods remaining, considering that in general the talks to advanced students will be made in March or April.

3. A separate talk will be recommended to Freshmen men and women, either early in the Fall or in the Spring, as desired by the school with particular emphasis on the necessity of planning their entire four years of high school to give adequate college entrance credit. These students will also be told something about Engineering as a profession, its advantages and drawbacks, and it is recommended that particular emphasis be made of the fact that an engineer or scientist should, nevertheless, have a well rounded high school curriculum in the humanities, particularly in English Writing or Journalism, if it is offered, because of a necessity that an engineer be able to make good communications.

4. Where it is possible and the high school has that service, we should be willing to talk to PTA groups, particularly those groups who have students about to enter high school. One of the pitfalls toward a student progressing correctly toward completing college entrance requirements in high school is apathy or unawareness on the part of the parents that such specific planning should be made.

5. We will arrange, where the principal desires, to talk to group meetings of teachers such as monthly meetings or the like, on engineering curriculum subjects.

6. We will strive to continue the honors awards at the annual Engineers' Week banquet but will not ourselves choose the student. We should urge the principals that the students be chosen on the basis of all around aptitude, personality, latent ability, and scholarship.

7. Through an overall area co-ordinator of Science Clubs we will try to have a man available who can talk to proper school authorities as arranged by the particular high school engineering consultant.

8. When sufficient interest in Science Clubs has been developed, we will try to promote a Science Fair as an outlet for competitive purposes and as a reason for projects.

9. We will endeavor to assist the program of the Boy Scouts of America in developing a list of engineers who are willing to sponsor individual boys on a "Man-to-Boy" basis in the scouting program of this nature which assists a boy in proper pursuance of his high school career after he has once chosen a profession. At present this is available to Eagle Scouts only, but it is understood that the scouting organization wishes to extend this to all boys of 14 years or older who make application for the sponsorship.

ASQC extends its heartiest congratulations to Dr. Toulouse for this well deserved honor and for the fine work he has done to earn this distinction.

section briefs

ALBANY . . . "Simplifying the selection of a sampling plan" was presented by T. A. Budne, Rath & Strong, as the feature of the February meeting. The problem session which was led by Dr. G. Tuttle and Maynard Wells, General Electric Co., presented a method which was derived by J. Dolby for determining the best frequency required on a large lot from the numerical results obtained from an initial small sample.

ALLENTOWN-BETHLEHEM . . . Four practical applications of QC in four different industries were presented by Paul Connolly of Dixie Cup Co., Harry Hemmerle of the U. S. Signal Corps, Anthony Morfy of Atlas Powder Co., and Al Pettit of Western Electric Co. at the February local participation night. That the down to earth practical approach appealed to the audience was shown by the presence of many old faces which had not been seen for many meetings.

BALTIMORE . . . Several members of the section attended the Middle Atlantic Conference which was held Feb. 28-Mar. 1 and reported a splendid program and a fine time. This event took the place of the regular February meeting.

The always popular and well attended May dinner meeting will be held at one of the downtown hotels. Leonard A. Seder, who is well known nationally in ASQC circles as a result of his many years of activity in the Society, will be our featured speaker. As befits this particular occasion, which is especially directed to management phases of QC, Mr. Seder's talk will deal with "Interesting aspects of the quality control-management relationship." A fine dinner and excellent program are in store for all.

BATTLE CREEK-KALAMAZOO . . . The February meeting was held at the Upjohn Co., Kalamazoo. The speaker for the evening was Dr. E. Whiting who presented a paper on "The basis for interpreting results from a testing process." His talk dealt with analytical chemistry and the intelligent use of statistics to aid this field in industry.

On Feb. 20 section member R. C. Paris presented a paper entitled "Quality control in the paper industry" at the monthly meeting of the Cumberland, Md. section.

The May 2 meeting will be a social evening featuring ladies night and introduction of new officers. This meeting will be held at the American Legion Hall, Battle Creek, and will be a dinner meeting starting at 6:30 pm.

BUZZARDS BAY . . . George R. Scheel, Sonotone Corp., discussed "Quality control in the manufacture of hearing aids" at the Feb. 11 meeting. Hans Picard of the Aerovox Corp. introduced the speaker. Kenneth Bennett of Revere Copper and Brass Company presided at the lively session.

CHATTANOOGA . . . The high spot of the year for the section was the Feb. 26 "Management Night" meeting. Eighty-nine members, guests, and members of local management were privileged to hear Dr. A. V. Feigenbaum, manager of quality control service for the General Electric Co., speak on "Total quality control and business profitability."

CHICAGO . . . At the February general meeting, over 50 members and guests of the section were treated to three excellent talks on reliability of manufactured items. Ralph Haertell defined the reliability problem, Joseph T. Heller described the engineering approach to it, and May-Goodwin Tarver reviewed for us a statistical technique for dealing with reliability data.

CINCINNATI . . . At the February meeting, Charles A. Bicking of The Carborundum Co. spoke on "Applications of industrial statistics in research and development."

The section participated in the observance of Engineer's Week as a member of the Technical and Scientific Societies Council of Cincinnati in its recognition of Dr. Howard K. Justice as "Engineer-scientist of 1957 in Cincinnati," at the University of Cincinnati on Feb. 21.

Efforts of the section in the Central Kentucky area have borne fruit—the Lexington, Ky. petition for section membership was approved. Cincinnati's ex-treasurer, Larry Girton, was elected vice-chairman of the newly formed group.

On May 21 G. G. Parkin of the Minnesota Mining and Mfg. Co. will speak on "Tests of significance in industrial processing."

COLUMBUS . . . A. E. Salisbury will speak on "A practical approach to machine capability studies" at the May meeting. In his talk, Mr. Salisbury will point out some interesting recent developments in determining machine capabilities and product specifications.

CORNING-ELMIRA . . . The section would like to thank Robert Sullivan, director of quality control of Vickers, Inc., for his talk on "An approach to quality control." Honorable mention should be made of the wonderful roast beef buffet dinner for which it would be hard to find a quality equal.

CUMBERLAND . . . R. C. Paris, director of quality control at the KVP Co., discussed "Quality Control in the paper industry" at the Feb. 20 meeting. Members and friends of the section who are employed by West Virginia Pulp and Paper Co. were particularly pleased that Mr. Paris was able to speak to our group.

DALLAS-FORT WORTH . . . O. R. Weaver, Phillips Petroleum Co. and former chairman of the Waco section, effectively developed examples of applications or misapplication of statistical techniques, quality control propaganda, and all supervisory and executive training as a means to combat cost in "Interesting management in quality control."

R. W. Anderson, supervisor of quality control engineering for the Semiconductor Division of Texas Instruments, Inc., capably explained "Experimental designs and variance component analysis" on Feb. 12.

A basic quality control course was completed on Mar. 4 at Arlington State College.

The May 8 tour through Texas Instrument's new Semiconductor-Component Division (the world's leading manufacturer of transistors) promises to be extremely interesting because the building is unique in industrial architecture.

EVANSVILLE-OWENSBORO . . . L. A. Seder, consultant and Fellow of ASQC, was the speaker at the Feb. 27 meeting. Mr. Seder's subject was "Who is responsible for quality?"

The first basic course in QC offered by the section began Feb. 26. Sessions are held at Central High School each Wednesday night from 7-9 and will continue for ten consecutive weeks.

The annual ladies night dinner will be held at the Hotel Soaper in Henderson, Ky. on May 20. The new officers will be installed at this meeting.

GREATER MUSKEGON . . . Fifty-eight members and wives gathered at Bill Stern's Steak House for the section's annual "Ladies Night" program on Feb. 13. Gaylor E. Smith, assistant sales manager of Muskegon Piston Ring, presented "Wonderful India," which was accompanied by descriptive slides. Door prizes were won by Messrs. Porter, Pascavis, Milane, and Elliott.

The section will hold a joint meeting with the Personnel, Safety, and Production Control groups at Bill Stern's Steak House on May 5. Only tentative plans have been made for this annual gathering of the four groups which is sponsored by the Muskegon Manufacturer's Association.

HAMILTON-MIDDLETOWN . . . At the Feb. 12 meeting, Harmon Bayer presented a most interesting and informative paper on "How to organize a QC program that pays." Prior to the meeting, a tour of the Hamilton Division of Fisher Body was made by the members.

The topic of the May 14 meeting will be a round table discussion. The success of our last year's round table meeting when we had the Cincinnati and Hamilton-Middletown educators serve as a panel has encouraged us to repeat the same type of program for the May meeting this year. Because the questions that provoked the greatest discussion last year were those involving purposes and policies of the Society, we plan this year to invite our District 8 past and present representatives, and other current officers, to sit on the panel so that we can have them explain the functions of ASQC to us. Such a program should prove interesting to every member.

Officers-elect for the 1958-59 season will also be announced at the May 14 meeting.

HARTFORD . . . Herbert A. France, Jr., manager of quality at the E. Ingraham Co., gave a very interesting talk on "Random balance." He reviewed the random balance design of experiment and using specific examples in the metal cutting operations analyzed the experimental and test results, as well as the pneumatic and electrical gaging involved.

HUNTSVILLE . . . J. Alfred Davies of General Electric's Owensboro Tube plant spoke at the February meeting on "Variables sampling without calculations" and discussed a sampling plan utilizing use of the median and quasi-range.

INDIANAPOLIS . . . The nominating committee is at work nominating officers for the coming year. We are very fortunate in having some very able and well equipped people for these jobs.

The May 13 meeting is one which members and guests always look forward to as we are all very proud of our "500 Race Nite."

LANSDALE . . . Dr. Hale Sweeney of the Atlantic Refining Co. was our guest speaker on Feb. 13. His lecture was entitled "Evolutionary operations research in the plant" and was with color slides. This was followed by a very lively discussion period on the selling points of different brands of gasoline.

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"Lansdale Quality Control Week" was recently celebrated. An official proclamation of the event is reproduced below.

PROCLAMATION

Borough of Lansdale
Montgomery County, Pennsylvania

WHEREAS, the Lansdale Section of The American Society for Quality Control is an organization dedicated to matters of providing quality products for the American economy and residents of the North Penn area.

WHEREAS, this society would call public attention to the work of its members and associated firms in providing more efficient standards in production and management techniques through the proper use of statistical quality control.

WHEREAS, it is the duty of each corporate member of the society to maintain the dignity of his chosen profession and to render proper service to individuals and the public.

WHEREAS, these efforts are carried on in the public interest as a part of the operations of commerce, industry and government:

NOW THEREFORE, I, E. K. BEAN, Burgess of the Borough of Lansdale do declare the week beginning February seventeenth as

"LANSDALE QUALITY CONTROL WEEK"

in recognition of the work of this organization and its members in the interests of obtaining quality products for use within our national economy, and hereto set my hand and affix the seal of the Borough of Lansdale.

February 12, 1958

/s/ E. K. BEAN
Burgess
Borough of Lansdale

LANSDALE SECTION GOES TO PRISON! That's right! On May 8 our section will have dinner and tour the State Penitentiary at Gratersford. At this time we will have the installation of officers for the new season. We understand from the Warden that it is easy to get into the prison—we hope we're out by the beginning of next season.

LOS ANGELES . . . Reliability was the keynote for the Feb. 11 meeting with Mr. Bealieu and Mr. Connors examining the various approaches to attaining the reliability goals of today.

On Apr. 23 the section and UCLA will jointly sponsor a conference on "Experimental techniques in science and industry," featuring lectures by Dr. George E. P. Box of Princeton University.

LOUISVILLE . . . The February meeting led off with the announcement of a membership drive ending Mar. 15 with awards to those sponsoring the most new members. The speaker of the evening, Ray Snyder of International Harvester, presented a very interesting analytical technique titled "The moving range of two."

The education committee announced that 22 persons were registered in the annual advanced course in quality control and data analysis which began Feb. 11.

MEMPHIS . . . Edward M. Schrock, member of the board of directors of ASQC and chief quality control engineer for American Radiator and Standard Sanitary Corp., spoke on "How to organize an effective QC program" at the Feb. 7 meeting. Many new and sound ideas on QC programs were received from Mr. Schrock.

At the May 2 meeting the section will have Paul K. Leatherman, Mallinckrodt Chemical Co., who will speak on "Vendor rating."

MICHIGAN . . . The Sixth Annual Dinner Dance of the Michigan Section took place Feb. 15 at the Sheraton Cadillac Hotel in Detroit. The Book-Casino Room, noted for its intimate night club flavor, was the scene of festivity.

Bob Maxwell, famed Detroit disc jockey of WWJ Radio and TV, was our thoroughly enjoyable Master of Ceremonies for the evening, which was truly "social" with a fine dinner and continuous dancing to the music of Johnny Titus and his Band.

We were indeed honored to have as Guest of Honor Society President Leon Bass.

The highlight of the evening was the final selection of "Miss Quality Control" Michigan Section. Preliminary judging had screened lovely entrants from nearly all phases of Michigan Industry and on this night, from seven finalists, Miss Quality Control was selected. We are very proud to introduce Miss Andrea Young as Miss Quality Control. She is with the Army Ballistic Missile Agency, Chrysler Missile Plant, Warren, Michigan. We sincerely hope that she does not entertain any thoughts of hitch-hiking a ride to the moon.

We were able to induce Mr. Bass, Mr. Clarence Burdick, Mr. Harmon Bayer and Mr. Stan Sherwood to judge this

The Queen, her court, and a friend. Miss Andrea Young was selected as Miss Quality Control Michigan section at the annual dinner dance of the section.

12th Mid-West Conference at Chicago, Illinois

The Mid-West Sections of the American Society for Quality Control with co-sponsorship of the Chicago Association of Commerce and Industry held their 12th Mid-West Quality Control Conference in the Sherman Hotel in Chicago, Illinois, on October 24 and 25. In addition to a diversified program, including 20 separate formal presentations, an elementary training program was held at the conference. Continuing growth of interest in Quality Control was demonstrated by the participation of 136 of the conference registrants in the elementary training program.

On the first day of the conference, Titus G. LeClair presented the featured luncheon address in the form of a concise summation of modern applications of "Quality Control in the Electric Service Industry." *(Editorial note: The text of Mr. LeClair's luncheon address appears on page 9 of this issue.)*

Shown in the photograph is Conference Chairman Charles L. Matz welcoming (left to right): Harry L. Wylie, Director of CACI; Philip R. Clarke, Jr., Director of CACI; Titus G. LeClair, Luncheon Speaker; Bertram J. Cahn, Director of CACI; and Clyde G. Randolph, Director of CACI.

The final selection of Miss Quality Control Michigan section was in the very capable hands of (left to right) Harmon Bayer, section chairman; Edward P. Ford, section director; C. Robert Webster, Midland subsection; Stanley B. Sherwood, national director; and Clarence R. Burdick, Society vice president.

event. That they are steadfast exponents of statistical techniques is evidenced by their astute analysis of the normal curve.

We are certainly thankful to Gail Phillips, our Program Chairman and Bob Vujovich, Dinner Dance Chairman, for providing this excellent get together for over 200 Michiganders, who attended in spite of some of the worst weather of the winter.

MID-HUDSON . . . Thirty-six members and guests heard Dr. R. H. Bacon give a very interesting and informative talk on "Sequence or runs in correlated data" at the February dinner meeting.

The guest speaker for the May 6 meeting at the Anchor Inn in Poughkeepsie will be R. M. Hofstead whose topic will be "Application of statistics in pharmaceutical manufacture."

John Losee, section chairman, appointed the nominating committee for the 1958-59 season which included William Bobalke, Harry I. Sanctuary, and Louis P. Marien.

MILWAUKEE . . . The panel discussion has always been favorably received and this one on "Vendor-vendee relations" was no exception. A large turnout contributed to a very successful evening. Questions flew thick and fast and these were ably answered by our panel consisting of Clarence Spahr of International Harvester Co., George Thompson of John Oster Co., Larry Neuman of Miller Brewing Co., and Bill Kohl of Allis-Chalmers Co.

The two educational sessions preceding the meeting were also very well attended. The subjects were "Analysis of variance" and "Kurck-C process analysis."

MINNESOTA . . . A panel discussion "Management Night" was attended by 75 members and guests. Professor Gayle W. McElrath of the University of Minnesota moderated a four man panel of management representatives from Minneapolis Honeywell, Cornelius Co., Toni Co., and Remington Rand Univac. Many questions from the floor led to a spirited discussion and indicated the popularity of this type of program.

MONTREAL . . . On Feb. 11 J. Y. McClure spoke on "Vendor control and product control."

On May 14 Kenneth G. Cook will talk on "Vendor-vendee problems in the metal industry."

The executive is working on preparing for the annual dinner meeting and the date and speaker will be announced in the next issue.

NEW HAVEN . . . Miss Bessie B. Day and F. R. Del Priorre presented their three act play "The engineer and statistician can meet" on Mar. 11 at the Rathskeller of the Hull Brewing Co.

On May 13 D. H. Taylor, quality control engineer of the Freiz Instrument Division of Bendix Aviation Corp., will talk on the "Relationship between industrial engineering and quality control" at a dinner meeting to be held at Reilly's Restaurant, Hamden.

NORTHWESTERN INDIANA . . . Henry J. Jacobson, consultant with the Indianapolis firm of Sutherland-Jacobson & Associates, addressed the Feb. 13 meeting. Mr. Jacobson discussed various phases of QC having to do with "Human engineering in QC." Mr. Jacobson has served as quality control manager, engineer, and consultant for a number of companies and has combined his career with the writing of books and technical papers. The address was well received by a large turnout of the membership and interested guests.

OMAHA-LINCOLN . . . Twenty-four members and 17 guests attended the Feb. 21 meeting. Leon Bass, Society President, spoke on "General quality control."

PHILADELPHIA . . . The dinner meeting and past chairman's night scheduled for Feb. 20 had to be postponed because of a severe snow storm but was held at a later date with D. Kirk of Moore Products Co. speaking on pneumatic gaging.

On May 16 a plant visitation will be made to the Red Lion plant of the Budd Company at Red Lion and Verree Roads. This plant produces stainless steel lightweight railway cars and automotive chassis on an automated line. Numerous quality control applications are used throughout the plant. The tour will be followed by a dinner meeting at the Rye Country Club in Huntington Valley.

PHOENIX . . . A. R. Pennell, section chairman, announced the appointment of Walter Klontz and Bob Miller as co-chairmen of a one-day symposium on "Management, quality, and costs" to be held at the Westward Ho Hotel on May 10. Plans are underway for presentation of several papers by well known authorities in the fields relative to the symposium theme.

PITTSFIELD . . . An afternoon-evening session was held at the Stanley Club on Mar. 6. Dr. Elis R. Ott, Society vice president, conducted both sessions on "Basic concepts of QC" and "Means of making a QC program effective." Excellent attendance showed the aroused interest for quality control in Berkshire county.

Ralph E. Burt of the National "U" Association will conduct the monthly meeting to be held at the Stanley Club on May 7. Mr. Burt will discuss motivation in his talk "The 'YOU' attitude, new response motivation." Operator participation being essential to good QC insures a wide interest in better motivation of workers for higher quality.

RHODE ISLAND . . . Spirits not dampened by the snowstorm, the section enjoyed a most interesting and informative session as Oscar H. Bishop, vice chairman of the Society's Metals Technical Committee and quality control manager of the Reynolds Metals Co., discussed "Quality control in the production of aluminum foil."

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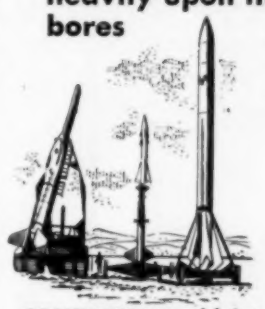

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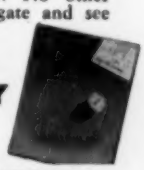

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SECTION CALENDAR (APRIL 20—MAY 31)

SECTION	DATE	PLACE	TIME	SUBJECT	SPEAKER
Albany	May 15	University Club	4:30 pm	Section Conference	——
Baltimore	May 13	——	6:30	Interesting Aspects of the QC-Management Relationship	Leonard A. Seder, Consultant
Battle Creek-Kalamazoo	May 2	American Legion Hall, Battle Creek	6:30	Social Evening—Ladies Night and Introduction of New Officers	——
Buzzards Bay	May 13	Continental Screw Co.	8:00	Statistical Methods in Steel Technology	J. W. Sullivan, American Iron and Steel Institute
Chattanooga	May 13	Patten Hotel	6:30	Ladies Night	——
Chicago	Apr. 23	Lawson YMCA	5:00	Joint Meeting with Administrative Applications Division	——
(Calumet)	May 6	Mike Spiccia's Restaurant	6:30	A Discusson of Factoral Chi Square	Ralph Huth, U. S. Steel Corp.
Cincinnati	May 21	Engr. Soc. Bldg.	8:00	Tests of Significance in Industrial Processing	G. G. Parkin, Minnesota Mining and Mfg. Co.
Columbus	May 21	Westinghouse Electric Corp.	8:00	A Practical Approach to Machine Capability Studies	A. E. Salisbury, American Airlines, Inc.
Corning-Elmira	May 13	Corning	8:00	Management Night	Stuart Beekman, General Electric Co.
Cumberland	May 1	Fort Cumberland Hotel	6:30	Experiments with Many Variables	W. S. Connor, National Bureau of Standards
Dallas-Fort Worth	May 8	Texas Instruments, Inc.	8:00	Plant Tour	——
Evansville-Owensboro	May 20	Hotel Soaper, Henderson, Ky.	7:00	Ladies Night	——
Greater Muskegon	May 5	Bill Stern's Steak House	6:30	Joint Meeting with Safety, Production Control, and QC	——
Hamilton	May 8	Canada Westinghouse Auditorium	8:00	Statistical Acceptance Sampling and Practical Application	R. Vance Ward, C.I.L.
Hartford	May 20	Club Alden	8:00	Controlling the Quality of Management Decisions	Dorian Shainin, Rath & Strong, Inc.
Lansdale	May 8	State Penitentiary, Graterford	7:30	Installation of Officers, Dinner, and Tour	——
Los Angeles	Apr. 23	——	——	Experimental Techniques in Science and Industry	Dr. George E. P. Box, Princeton University
Louisville	May 12	GE Appliance Park, Bldg. 4	8:00	Life Test Acceptance Sampling	Al Davies, General Electric Corp.
Memphis	May 2	Memphis State University	8:00	How Can a Vendor be Rated	Paul K. Leatherman, Mallinckrodt Chem. Co.
Mid-Hudson	May 6	Anchor Inn, Poughkeepsie	7:00	Application of Statistics in Pharmaceutical Manufacture	R. M. Hofstead, Bristol Laboratories, Inc.
Milwaukee	Apr. 21	Stratford Hotel	6:30	Management Night	W. W. Kauffman, RCA
	May 5	Miller Brewing Co.	——	Annual Business and Social Meeting	——
Minnesota	May 13	Hamms Brewery	7:30	Business Meeting	——
Montreal	May 14	CIL Bldg.	8:30	Vendor-Vendee Problems in the Metal Industry	Kenneth G. Cook, Thomas & Betts Company, Inc.
New Haven	May 13	Reilly's Restaurant, Hamden	6:00	Relationship Between Industrial Engineering and QC	D. H. Taylor, Bendix Aviation Corp.
Omaha-Lincoln	May 9	Lincoln	7:00	——	O. R. Weaver, Phillips Petroleum Co.
Philadelphia	May 12	The Budd Co.	——	Plant Tour	——
Phoenix	May 10	Westward Ho Hotel	——	All-Day Symposium—Management, Quality, and Costs	——
Pittsfield	May 7	Stanley Club	7:00	The "YOU" Attitude, New Response Motivation	Ralph E. Burt, National "U" Association
Rhode Island	May 17	Providence Engr. Soc. Bldg.	8:00	Simple Techniques for Adjusting Plans to Sales Trends	Ernest H. Robinson, Johnson & Johnson
Rochester	May 5	Great Western Wine Co., Hammondsport	3:00	Food and Beverage Sub-Group Meeting and Plant Tour	——
St. Louis	May 16	Golden Fried Chicken Loaf Restaurant	6:30	Fundamentals of Sequential Analysis	Prof. Gayle W. McElrath, University of Minnesota
South Bend-Mishawaka	May 2	Pick-Oliver Hotel, South Bend	8:00 am	Annual All-Day Conference	General Chairman: Wayne Miller, Bendix Aviation Corp.
	May 15	Bendix Legion Post, South Bend	6:00 pm	Principles of Techniques and of Precision Measurement	J. A. Harrington, DoALL Company
South Texas	May 14	Ben Milam Hotel, Houston	7:30	How We Sample Income Tax Returns	A. C. Rosander, Bureau of Internal Revenue
Toledo	May 1	V.F.W. Post 606	6:30	Stimulating Operator Interest in QC	J. Frederick Verigan, Crown Cork & Seal Co.
	May 17	Devil's Lake	——	Picnic	(Arrangements by Mrs. Beatrice M. Dorn)
Toronto	Apr. 25	Rexdale	8:00	Plant Visit—General Mills	——
	May 7	Sign of the Steer	6:00	Quick and Dirty Methods Used in SQC	S. Prout, Canadian Controllers, Ltd.
Washington, D. C.	Apr. 23	Occidental Restaurant	6:30	——	——
Worcester	May 15	Worcester Polytechnic Institute	7:00	Quality Control as Seen by the Manufacturing Executive	Harold E. Clayton, Bay State Abrasive Products Co.

The May 17 meeting will feature Ernest H. Robinson, director of quality control of Johnson & Johnson, who will discuss the "Simple techniques for adjusting production plans to sales trends."

ROCHESTER . . . The food and beverage sub-group is planning a plant tour for May 5. Host will be the Great Western Wine Co., Hammondsport. Meet at Great Western promptly at 3 pm. Light refreshment will be served at the plant after the tour.

The 14th annual clinic at the War Memorial was a gratifying success. Despite blizzard weather more than 800 members and guests gathered to hear 18 speakers give 20 lectures and panel discussions.

ST. LOUIS . . . The nominating committee submitted their slate of candidates at the March meeting. The ballots will be cast by mail and the results noted in the next issue. The new officers will be installed at the May meeting.

Ralph Mannering and H. O. Hehner of Monsanto Chemical Co. have been appointed co-chairmen of the one-day fall clinic which will be held early in October.

SAN ANTONIO . . . R. L. Storer, assistant manager of the quality control branch of Asterdyne, Inc., presented a paper on the "Importance of quality control in contracts" at the February meeting. A question and answer period followed his presentation which was most informative to all. Prior to the start of the meeting, a short social session was held at which coffee and cake were served and enjoyed by all.

SAN DIEGO . . . A highly interesting and informative panel discussion was provided at the Feb. 10 meeting. The panel, drawn from one aircraft plant (Solar Aircraft Company) included division managers and department heads from quality control, production engineering, and production. The theme was "Quality control from mechanic to president."

REGIONAL CONFERENCE—The San Diego Section is privileged to host the 1958 Western Regional Quality Control Conference. The theme, "Quality Control at the Modern Pace," is indicative of the era in which we live. The place is the beautiful El Cortez Hotel, overlooking San Diego and the "Harbor of the Sun." The dates are August 7 and 8.

Take that long-planned vacation in Southern California to coincide with these important dates. MAKE YOUR RESERVATIONS EARLY.

SOUTH BEND-MISHAWAKA . . . Frank G. Kelley's "A brief case for business" was the highlight of the most successful ladies night program ever staged by the section. His combination of humor and serious persuasiveness convinced all that "big business" is essential to the American economy. Research can only be financed by big business.

Election of officers for the 1958-59 season will be held at the annual dinner-business meeting on May 15 at the Bendix Legion Post, South Bend.

The annual all-day technical session will be held on May 2 at the Pick-Oliver Hotel, South Bend. The general chairman will be our section chairman Wayne Miller. The sessions will be highlighted by industrial exhibits, a plant tour of the Bendix Products Division, a welcoming address by South Bend's Mayor, the Honorable Edward Voorde, and technical addresses by three of the most capable men available. The technical addresses are: "Vendor quality customer relations" by P. B. Niland, manager of analysis and procedure at the Ford Motor Co.; "The Challenge of reliability" by W. A. MacCrehan, Jr., manager of quality control at the Bendix Radio Division; and "Quality—key to survival" by Hugo Petersen, staff executive in charge of training for the Bendix Aviation Corp.

SOUTH TEXAS . . . The section met for its regular monthly dinner meeting on Feb. 12. Those who braved the elements to attend heard R. W. Anderson deliver a paper for Dr. A. W. Wortham, chief of operations research for Texas Instruments, Inc., who was unavoidably absent. The subject of his talk was "Experimental designs and variance components."

The third pre-meeting training session was conducted by Dr. J. T. Elrod of the University of Houston on "The uses of binominal probability paper."

STATE UNIVERSITY OF IOWA . . . Fifty members attended the Feb. 27-28 meeting at Davenport. Both the tour of the Red Jacket Mfg. Co. and a report by Marvin Brown, chief assistant engineer of Red Jacket, brought out how quality control helped in their manufacturing of jet and submerged water and gasoline pumps. The always effective and thought provoking Gayle W. McElrath led the technical session in a look into "Economics of SQC" with consideration of efficiency or accuracy values versus cost of preparation as the theme.

TOLEDO . . . "Industrial experimentation" was the subject of Miss Besse B. Day's discussion at the Feb. 6 joint meeting of the Toledo sections of ASQC, AIChE, ASME, AIIE, and ASTE at the Maumee River Yacht Club. Through liberal use of slides, Miss Day cited some of the advantages of statistical design of experiments over conventional testing methods in obtaining maximum information from a minimum amount of testing. Miss Day is chief statistician for the Bureau of Ships, Department of the Navy, Washington, D.C.

"Stimulating operator interest in quality control" will be the subject of J. Frederick Verigan, manager of quality control, Crown Cork & Seal Co., at the May 1 dinner-meeting to be held at 6:30 pm at the VFW Post 606, 1901 Tremainsville Rd., Baltimore, Md.

May 17 has been selected for the annual picnic to be held at Devil's Lake for husbands and wives. Chairman Beatrice M. Dorn and her committee assure a good time to all.

TORONTO . . . The section met on Feb. 12 for a very interesting lecture entitled "Discovery sampling by attributes." This technique was expertly explained by Ervin F. Taylor, Westinghouse Electric Corp. The section was also favored with the presence of Society vice president C. E. Fisher, who is visiting some of the sections to keep them up to date on the latest developments. Mr. Fisher explained the centralization and streamlining of the national office functions, the growth and future of "Industrial Quality Control," and the hard work of our special committee on professionalism.

The section concluded the month with a very successful management conference. The guest speaker was W. M. Bristol III, president of Bristol Myers Products Division, who addressed the large audience on the subject "Quality control comes of age." The panel discussion entitled "Management decision making" under the enthusiastic guidance of the panel leader, Prof. A. E. Allcut, M. Sc. ME, was a complete success.

WINNEBAGO . . . The February meeting was held at the Elk's Club, Appleton. The principal speaker at the dinner meeting was Society vice president Henry J. Becker, production control manager of American Steel & Wire Div., U. S. Steel Corp. Mr. Becker spoke on controls as they applied to the wire division and also gave a breakdown on the functions and organization of the Society.

A training session on correlation and regression preceded the dinner meeting and was conducted by Dr. Carl Noble.

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WORCESTER . . . On Feb. 27 W. A. McCrehan, Jr., quality director of Bendix Radio Division, presented an excellent talk on "Reliability." There was excellent response and interest from the audience as indicated by the questions. The meeting, which was held at the Worcester Polytechnic Institute, was attended by 40 people. Included in the audience were Mr. and Mrs. Charles Hudson, two staunch supporters of the section.

WASHINGTON, D. C. . . . On Feb. 26 John Riordan, staff director for inspection and QC, Office of the Secretary of Defense, presented recent and future developments in inspection and quality control in the Department of Defense. Irving Altman and Samuel Skolnik assisted.

SIGNIFICANT DIFFERENCES

. . . Chicago—Section treasurer Howard Jones, general supervisor of statistics for the Illinois Bell Telephone Co., has been elected National Vice President of the American Statistical Association.

On Mar. 18, Carl Bauer, production quality control supervisor for Abbott Laboratories, addressed the American Management Association's Packaging Clinic on the subject of "The quality control department evaluated the flexible package—films—laminated films."

. . . Cincinnati—Jack Gantt of G. E. Evendale plant is having lots of fun talking to civic groups with his "gamblers math" and quality control program.

Section chairman Bill Barker has been elected village councilman in Blue Ash, for a two year term.

Bill Eilrich of G. E. Evendale plant has had a paper on quality control published in "Modern Machine Shop" magazine.

. . . Cumberland—Chemical engineer William H. Harlacher has joined Allied Chemical and Dye Corp. as nylon extrusion development engineer. He was formerly employed by Celanese Corporation of America.

Leland J. Murphy has become a member of the recently organized analytical development team at Celanese Corporation of America. George R. Mease has also joined the analytical development team.

. . . Greater Muskegon—Arthur Peltier, Muskegon Piston Ring Co., has been appointed by Michigan's Governor Williams to serve on the newly-created Water Safety Study Commission. Mr. Peltier is also chairman of the Muskegon Water Safety Council.

. . . Memphis—Dudly Robinson, section chairman, was invited to serve on the Memphis mayor's committee for establishment of a technical library for the city of Memphis.

. . . Milwaukee—Ray Kraetz and Jack Comiskey have joined the A. O. Smith quality control staff. Both men were students on the A. O. Smith trainee program prior to their present positions. Mr. Kraetz is a graduate of Marquette University and Mr. Comiskey comes from Loyola in Chicago.

. . . Montreal—George Williams of Northern Electric transferred from methods engineering to quality control engineering.

Ed Longhurst, formerly of Sperry Gyroscope, is now with RCA Victor.

. . . Philadelphia—Paul Green, previously an instructor of statistics at the University of Pennsylvania and most recently an operations research analyst at a large steel company, is now with DuPont in Wilmington, Delaware as an economist.

. . . South-Bend-Mishawaka—John Wupezak of Bendix Products Division's Automotive Division, has been promoted from automotive liaison engineer to chief draftsman.

Milwaukee Section Has Professional Status Drive

In an effort to promote the professional status of its members, the Milwaukee section recently sent a letter to its regular members inviting them to review their qualifications and submit an application for senior membership. As a result of this single canvass, 25 members were elevated to senior status bringing the section's total to 79 senior members and 3 Fellows out of a total section membership of 214. This gives the Milwaukee section 36.9% senior membership as compared to the national average of just under 20%.

It was felt that such solicitation would renew the interest of the members in the possibilities of increasing their professional status, and it has proven the point very well. Such a program is recommended for all sections in view of the recent drive toward professionalism in the quality control field.

BOOK REVIEWS

W. D. Baten, Editor

26 University Drive, East Lansing, Mich.

WORK SAMPLING, by Ralph M. Barnes, John Wylie & Sons, Inc., price $7.95. Reviewed by Nelson G. Meagley, Lincoln Div., Ford Motor Company.

Dr. Barnes has prepared a handbook to assist in the introduction of work sampling techniques into the industrial engineering departments of business organizations. The statistical devices are similar to established SQC methods, and the book will be of special interest to those now working in statistical quality control.

Work sampling was pioneered by L. H. C. Tippett. In 1934 he published a paper on snap reading methods for making time studies in the English cotton industry. Dr. Barnes has developed these concepts as a logical extension of practices now followed in industrial engineering. Sample observations are made of work as it is being processed, and this is used to determine the percentage of time spent by operators waiting for stock, down because of machine failures, personal time, or any of the other duties they perform or delays which occur. Mathematical methods are developed to determine the number of observations required for stated degrees of accuracy and stated confidence levels. The binomial distribution is expressed so as to solve for the required sample size, and nomographs are included to eliminate the calculations required.

The work is more than a mathematical treatment of the statistics involved. Special attention is given to practices required to assure randomization of observations, to methods for obtaining cooperation of the people being tested, and to the cost comparisons between these techniques and already existing conventional methods. The use of mechanical data processing for reducing the calculations is illustrated in detail.

A large part of the volume is devoted to reprints of previously published accounts of different men, relating case histories of experiences in the application of work sampling in widely diversified work tasks. This includes clerical work, packaging and shipping operations, tool room machine utilization, duties performed by inspectors, time spent in polishing steel tubing and the way time is utilized by industrial supervisors, school teachers and hospital personnel.

Dr. Barnes devotes considerable space in his book to performance rating as a combined activity with work sampling, and he develops the statistical considerations required to properly evaluate this subject. A detailed account relates a study made at Atlantic Refining Company under Dr. Barnes' direction for

testing the workability of the principles discussed. The book shows the limitations of these methods in developing time values; and it also suggests that considerable savings can be made by the use of these methods in many types of industrial engineering applications.

The original pioneering paper in work sampling, published by Mr. Tippett in 1934, is reprinted as the final chapter in the book. This, combined with the case histories of actual experiences by different industrial engineers in applying these techniques, and the development of the statistical concepts used, makes the book an excellent document to assist the reader in obtaining a clear perspective of this new activity.

AIRCRAFT DIVISION NEWS

The Aircraft Division is planning a conference to be held in Dayton, Ohio on November 17 and 18. This year's meeting is being planned to offer a fine array of interesting subjects and excellent speakers.

The subjects of the conference are to be in the fields of (1) airframe and engine, (2) electronics, and (3) guided missiles. The general theme of the conference is to, (1) discuss quality control's present and future role in the manned and unmanned weapons systems, and (2) to promote new and usable quality control techniques. The past conferences have had a predominance of speakers and subjects primarily concerned with the latter category. This category, of course, is vitally necessary and will be continued. However, this year, the conference agenda will be balanced with general interest subjects presented by outstanding speakers, who will paint the "big picture" of the future quality control requirements.

The Program Committee of the conference is now soliciting speakers who wish to present appropriate and timely papers falling into the above categories. All readers are invited to suggest the names of speakers and their subjects which (1) relate to practical, technical SQC problem-solving techniques, or (2) are of general interest concerning quality control's present and future role in manned and unmanned weapons systems. The readers, of course, are also to consider themselves as potential speakers.

The Dayton Conference will also have a "Contributed Papers" session which will be for the purpose of presenting short papers which are in keeping with the general overall theme of the conference. Each speaker at this session will be allowed 20 minutes for his presentation, and the full paper will be published in the conference transactions. Persons desiring to present such papers should send them to:

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. . . ***30-May 2***—7th Region IRE Conference and Trade Show, Hotel Senator, Sacramento, Calif., sponsored by IRE, contact IRE 7th Region Conference, Hotel Senator, Sacramento, Calif.

MAY

. . . ***2***—Fifth Annual Conference for Engineers and Architects, Ohio State University, Columbus, Ohio, sponsored by the Ohio State University College of Engineering.

. . . ***9-10***—Virginia Academy of Science Statistics Section, Hotel Roanoke, Roanoke, Va., sponsored by ASA, contact Ralph A. Bradley, Professor of Statistics, Virginia Polytechnic Institute, Blacksburg, Va.

. . . ***12-14***—International Symposium on Instrumental Methods of Analysis, Shamrock Hilton Hotel, Houston, Texas, sponsored by ISA, contact H. S. Kindler, 313 6th Ave., Pittsburgh, Pa.

JUNE

. . . ***9-27***—Indiana Executive Development Program, Indiana University, Bloomington, Ind., sponsored by the School of Business, Indiana University, contact Thomas R. Bossort, Jr., Director, Indiana Executive Development Program, School of Business, Indiana University, Bloomington, Ind.

. . . ***11-13—Response Surface Methodology Course, Roosevelt University, Chicago, Ill., sponsored by Chemical Division, ASQC, contact Horace P. Andrews, Research Laboratories, Swift & Company, Chicago 9, Ill.***

. . . ***15-July 25***—Seventh Annual Advanced Management Seminar, University of Washing-

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ton, Seattle, Wash., contact Professor Jim Rosenzweig, Director, Advanced Management Seminar, College of Business Administration, University of Washington, Seattle 5, Wash.

. . . **16-20**—Statistics Methods, Brevard College, Brevard, N. C., sponsored by Institute of Statistics at North Carolina State College, contact Division of College Extension, Box 5125, State College Station, Raleigh, N. C.

. . . **16-28**—Management Course, State University of Iowa, Iowa City, Iowa, contact J. Wayne Deegan, 122 Engineering Bldg., State University of Iowa, Iowa City, Iowa.

. . . **16-July 26**—Undergraduate and Research Seminars in Statistics, University of California, Berkeley, Calif., contact David Blackwell, Chairman of the Department of Statistics, University of California, Berkeley 4, Calif.

. . . **17-20**—Annual Cornell University Industrial Engineering Seminars, Cornell University, Ithaca, N. Y., contact Andrew Schultz, Jr., Department of Industrial and Engineering Administration, Cornell University, Ithaca, N. Y.

. . . **23-July 2**—15th Annual Quality Control for Chemical Industries, Rochester Institute of Technology, Rochester, N. Y., contact Robert D. Pease, Rochester Institute of Technology, 65 Plymouth Avenue South, Rochester 8, N. Y.

JULY

. . . **28-Sept. 6**—Undergraduate and Research Seminars in Statistics, University of California, Berkeley, Calif., contact David Blackwell, Chairman of the Department of Statistics, University of California, Berkeley 4, Calif.

AUGUST

. . . **29-Sept. 1**—Statistical Conference, University of St. Andrews, Edinburgh, Scotland, sponsored by Royal Statistical Society, contact St. Andrews Conference, Attn: Miss U. Croker, Royal Statistical Society, 21 Bentinck Street, London, W.1, England.

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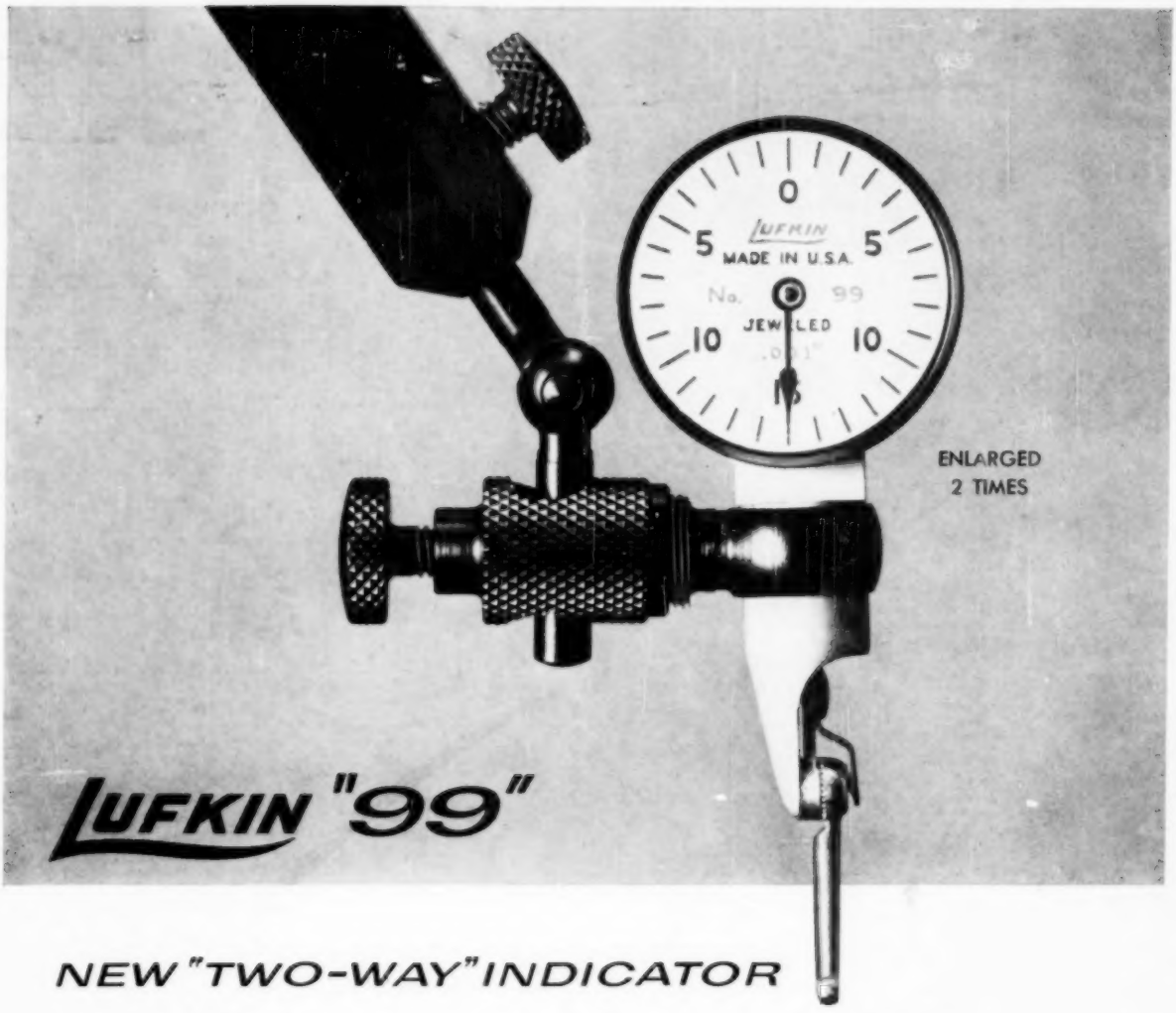

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